EK-LQP03-RM-001

# LQP03 Printer

## Programmer Reference Manual

digital

EK-LQP03-RM-001

# LQP03 Printer

## Programmer Reference Manual

Prepared by Educational Services
of
Digital Equipment Corporation

1st Edition, July 1984

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# CHAPTER 1
# INTRODUCTION

## 1.1 GENERAL

This manual provides detailed information used for program I/O control of the LQP03 Printer.

## 1.2 FEATURES

The LQP03 is a compact, full-character, letter quality printer designed for desk-top use in office or business applications.

Printing is bidirectional. You can select different character fonts by changing printwheels. For more information on printwheels contact the Digital Accessories and Supplies Group.

Higher level functions include proportional spacing, right justification, composite characters, bolding, and shadow printing.

The ribbon drive accepts both inked fabric and carbon film ribbons in an operator replaceable, disposable cartridge.

The primary paper feed system is friction feed using pinch rollers. The LQP03 supports a single-tray automatic sheet feeder option (LQPX3-SF) and a bidirectional forms tractor (LQPX3-FT).

The printer accepts ANSI standard 7-bit and 8-bit ASCII codes. It recognizes 128 printing characters plus 14 non-printing control characters. You can select two more printwheel petal positions with escape sequence commands.

The printer communicates in full-duplex mode through a universal synchronous/asynchronous receiver transmitter (USART). The printer usually operates under restricted modem control with a host computer through a null modem cable. It may also operate under limited full modem control for remote applications. (No checks are made for modem presence or carrier signal integrity.)

The printer mechanism is controlled by a microprocessor that contains a 256-character data input buffer. The microcode implements three levels of printer self-tests.

Logic Self-test -- Performed each time the printer is turned on or is initialized (RIS) by the program. Checks all loadable/readable registers on the processor bus. The processor halts if a fault is detected.

Printing Self-test -- Run under standard maintenance procedures. Exercises the printer's electro-mechanical mechanisms.

Loopback Self-test -- Run under standard maintenance procedures using a loopback connector. Checks the printer's communication capability.

## 1.3 SPECIFICATIONS

### LQP03 PRINTER

| | |
|---|---|
| Acoustical Output | 58 dBA maximum |
| Character Pitches | 10, 12, and 15 characters/inch |
| Data Interface | Serial RS-232C EIA Standard |
| Dimensions | 50.8 cm(W) X 20.32 cm(H) X 38.1 cm(D)<br>(20 in X 8 in X 15 in) |
| Environment (Operating) | |
| Temperature | 10o to 38o C (50o to 100o F) |
| Humidity | 10% to 90% |
| Environment (Storage) | |
| Temperature | -10o to 70o C (14o to 158o F) |
| Humidity | 2% to 98% |
| Fuse Rating | 3 Amp, 250 Volt, Slo-blo |
| Paper Specifications (Manual Paper Feed) | |
| Dimensions | 30.5 cm (12 in) wide maximum;<br>28.0 cm (11 in) print line |
| Weight | 16 to 24 lb |
| Thickness | .05 cm (0.02 in) maximum;<br>4 sheets maximum |
| Power Requirements | |
| LQP03-AA | 90 to 132 Vac (57 to 63 Hz) |
| LQP03-B | 180 to 264 Vac (47 to 53 Hz) |
| Power Consumption | 100 W maximum |
| Print Speed | 25 CPS, Shannon Text |
| Printwheel Type | 130 petal daisywheel, plastic |
| Resolution | |
| Horizontal | 120 increments/inch |
| Vertical | 48 increments/inch |

| | |
|---|---|
| Slew Speed | |
| Horizontal | 11 inches/second minimum |
| Vertical | 3 inch/second |
| Thermal Output | Approx. 410 BTU |
| Weight | 12.2 kg (27 lb) |

## LQPX3-FT BIDIRECTIONAL FORMS TRACTOR

| | |
|---|---|
| Tractor Drive | Bidirectional, unlimited movement |
| Paper Out Sensor | Microswitch on left tractor |
| Dimensions | |
| Width | 41.3 cm (16-1/4 in) |
| Height | 14.0 cm (5-1/2 in) |
| Depth | 28.0 cm (11 in) |
| Weight | 2.3 kg (5 lb) |
| Environment (Operating) | |
| Temperature | 10o to 38o C (50o to 100o F) |
| Humidity | 30% to 70% (no condensation) |
| Environment (Storage) | |
| Temperature | -10o to 70o C (15o to 160o F) |
| Humidity | 10% to 95% (no condensation) |
| Paper Specifications | |
| Width | 25.4 cm minimum to 305 cm maximum<br>(2 in to 12 in)<br>(including tractor strips) |
| Thickness | 0.03 cm maximum (0.013 in) |
| Hole Spacing | Standard 12.7 cm (0.5 in) |

## LQPX3-SF SINGLE-TRAY SHEET FEEDER

| | |
|---|---|
| Dimensions | |
| Width | 41.3 cm (16-1/4 in) |
| Height | 20.3 cm (8 in) |
| Depth | 28.0 cm (11 in) |
| Weight | 2.3 kg (5 lb) |
| Environment (Operating) | |
| Temperature | 10o to 38o C (50o to 100o F) |
| Humidity | 30% to 70% (no condensation) |
| Environment (Storage) | |
| Temperature | -10o to 70o C (15o to 160o F) |
| Humidity | 10% to 95% (no condensation) |
| Paper Specifications | |
| Capacity | 100 sheets (20 lb stock) |
| Minimum Size | 20.3 X 20.3 cm (8 X 8 in) |
| Maximum Size | 30.5 X 30.5 cm (12 X 12 in) |
| Weight | 16 to 24 lb bond |
| Texture | Most uncoated textures |
| Reverse Feed | Up to 1 inch for superscripts and subscripts |
| Print Registration (Horizontal and Vertical) | |
| 66% Frequency | within 0.10 cm (0.040 inch) |
| 95% Frequency | within 0.13 cm (0.050 inch) |
| Paper Skew (Over an 8 inch span) | |
| 66% Frequency | within 0.10 cm (0.040 inch) |
| 95% Frequency | within 0.13 cm (0.060 inch) |

## 1.4 ORDERING SUPPLIES AND MANUALS

### LQP03 SUPPLIES

### Options

| | |
|---|---|
| LQPX3-SF | Automatic Single-bin Sheet Feeder |
| LQPX3-FT | Bidirectional Forms Tractor |
| LQPX3-AC | Acoustic Cover |
| LQPX2-SW | Serial Interface Switch (two printers to one computer) |
| PCXXF-CZ | Serial Interface Switch (two computers to one printer) |
| PCXXA-AA | Crossover Switch (two printers to two computers) |
| PCXXF-CK | Stand, Brown |
| PCXXF-DF | Stand, Grey |

### System Interface Cables

**Rainbow 100**

| | |
|---|---|
| BCC04-10 | 10 ft |
| BCC04-25 | 25 ft |
| BCC04-50 | 50 ft |

**DECmate I**

| | |
|---|---|
| BC26S-05 | 5 ft |
| BC26S-15 | 15 ft |
| BC26S-25 | 25 ft |
| BC26S-50 | 50 ft |
| BC26S-A0 | 100 ft |

**DECmate II, III, and Professional**

| | |
|---|---|
| BCC05-10 | 10 ft |
| BCC05-25 | 25 ft |
| BCC05-50 | 50 ft |
| BCC05-A0 | 100 ft |

### Printwheels (Box of 6)

| | |
|---|---|
| LQP03-MA | Multinational Prestige Elite 12 |
| LQP03-MB | Multinational Courier 10 |
| LQP03-MC | Multinational Pica 10 |
| LQP03-MD | Multinational Gothic 12 |
| LQP03-ME | Multinational Bold Face |
| LQP03-MF | Multinational Orator 90% 10 |
| LQP03-MH | Multinational Gothic 15 |
| LQP03-MK | Scientific |

### Ribbon Cartridges (Box of 6)

| | |
|---|---|
| LQP03-KA | Multi-Strike Film |
| LQP03-KB | Fabric |

**Tractor Feed Paper (fanfold, 9-1/2 X 11 in)**

| | |
|---|---|
| H9850-PH | Single-part, white, 2700 sheets/box |
| H9850-PJ | 2-part carbonless, white, 1750 sheets/box |
| H9850-PK | 4-part carbonless, white, 800 sheets/box |
| H9850-PR | 2-part carbon, white, 1500 sheets/box |
| H9850-PS | 4-part carbon, white, 750 sheets/box |
| H9850-PV | Single-part, green and white bar, 3500 sheets/box |

**LQP03 MANUALS**

| **Part Number** | **Title** |
|---|---|
| EK-LQP03-UG | Installing and Using the LQP03 Printer |
| EK-LQ3FT-UG | Installing and Using the LQPX3-FT Bidirectional Forms Tractor |
| EK-LQ3SF-UG | Installing and Using the LQPX3-SF Single Tray Sheet Feeder |

The LQP03 Installing and Using manuals enable untrained users to install, operate, maintain, and perform elementary troubleshooting for a device.

**EK-LQP03-RM LQP03 Printer Programmer Reference Manual**
The LQP03 Printer Programmer Reference Manual describes the software commands which the host computer uses to control the printer. Some knowledge of programming is required to utilize these commands.

**EK-LQP03-PS LQP03 Printer Pocket Service Guide**
The LQP03 Printer Pocket Service Guide allows personnel with some technical background to perform servicing to the Field Replaceable Unit level.

**ER-LQP03-TM LQP03 Printer Technical Manual**
The LQP03 Printer Technical Manual contains a functional block level theory of operation, illustrated parts breakdowns, and electrical schematics. It allows trained personnel, with the necessary equipment, to perform servicing to the component level.

**SALES OFFICES**

Order supplies and manuals by contacting your local sales office or the appropriate address below.

**Continental USA and Puerto Rico**
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Sunnyvale, CA 94086

**Canada**
Call 800-267-6146

Digital Equipment Corporation
A&SG Business Manager
P.O. Box 13000
Kanata, Ontario Canada K2K 2A6
Telex: 610-562-8732

## 1.5 FIELD SERVICE INFORMATION

Your Digital hardware comes with a warranty that gives you access to the best Digital resources including our technical expertise, spare parts inventories and worldwide service organization.

After warranty, Digital support continues through a range of on-site and off-site service alternatives for as long as you own your Digital hardware. These services are designed to help you get the maximum performance from your system.

Our on-site services provide fast response and full support, including the cost of all parts and labor. You can choose between programs that offer around the clock service, committed response time, problem escalation, and engineering changes, as required.

### DECservice

DECservice is Digital's most comprehensive on-site service product. It provides committed response times including a 4-hour service response if your system is located within 100 miles of a Digital service location. DECservice also provides continuous repairs until the problem is solved, a program of preventive maintenance, installation of the latest engineering changes, and automatic escalation for complex problems.

And DECservice lets you choose the hours of coverage you need to support your application, up to 24 hours a day, 7 days a week.

### Basic Service

Basic Service offers economical, yet, full service coverage. Your calls for service receive priority status, second only to DECservice calls. You also receive preventive maintenance, installation of the latest engineering changes, and automatic escalation of complex problems.

Basic Service is available during standard business hours, 8 a.m. to 5 p.m., Monday through Friday.

**Per Call Service**
If your application doesn't demand comprehensive support, you can take advantage of one of Digital's Per Call programs.

Per Call Service is available on-site and off-site on a non-contractual basis. Service is available Monday through Friday during standard business hours, from 8:00 a.m. to 5:00 p.m.

For on-site Per Call Service, you pay for the time and materials required for each service call. Off-site Per Call Service is available through mail-in board replacement and carry-in system repairs.

**Carry-in Service**
This is Digital's low cost alternative to on-site support. You can carry your terminal into any of the 150 Digital Servicenters throughout the U.S. and pick up the repaired system within 2 days. Or, if you perform your own maintenance, you can carry-in your faulty module and make an over-the-counter exchange.

Carry-in service is available through a one-year, fixed-cost agreement or on a Per Call basis which charges a flat rate for labor, plus the cost of all parts used in the repair. All carry-in service and parts come with a 90-day warranty.

**DECmailer Service**
DECmailer is a return-to-factory replacement service for Digital customers who maintain their equipment to the module or subassembly level. It provides 5-day turnaround, free return shipping, 90-day warranty, 24-hour emergency service, monthly billing, and quarterly activity reports.

Whichever Digital service option you select, you will receive high quality, reliable service delivered by one of the largest service organizations in the industry.

**Educational Services Group**
Digital offers maintenance courses through the Educational Services Group at any of our 17 worldwide training centers; or, depending on your specific training requirements, courses can be provided in your own facilities.

**For More Information**
Call the Digital Field Service information number in your area during normal business hours.

| | | | |
|---|---|---|---|
| United States | (800) 554-3333 | France | (6) 077-8292 |
| Canada | (800) 267-5251 | Holland | (30) 640293 |
| United Kingdom | (734)-868711 | Switzerland | 01-8169111 |
| Belgium | (02) 242-5095 | Sweden | 08-7338000 |
| West Germany | (089) 95910 | Norway | (2) 160290 |
| Italy | (02) 617961 | Denmark | (2) 889666 |
| Japan | (03) 989-7161 | Spain | (1) 7331900 |
| Austria | (222) 6776410 | Ireland | (1) 308433 |
| Finland | (0) 423511 | Portugal | 1-725402 |
| Australia | (02) 4125555 | | |

# CHAPTER 2
# PRINTER OPERATION

## 2.1 GENERAL

This chapter describes LQP03 switches and indicators, which are divided into two groups.

Controls used for normal operating functions

Configuration switches reserved for use by the system manager or by authorized service personnel

Status changes or error conditions are reported to the printer's status protocol handler. Some of these conditions are signalled by indicators or enabled by switches. The printer sends a status report when polled by the program, but can also be enabled to send unsolicited reports.

## 2.2 SWITCHES AND INDICATORS

**Power Switch**
Pressing the "1" side of the power switch turns the printer ON. Pressing the "0" side of the power switch turns the printer OFF.

**Paper Advance Button**
Momentarily pressing the paper advance button advances the paper 1/48 inch. Holding the button down, continuously advances the paper one line at a time. The paper advance button has no effect if text is currently being printed.

**Paper Reverse Button**
Momentarily pressing the paper reverse button reverses the paper 1/48 inch. Holding the button down reverses the paper continuously, one line at a time. The paper reverse button has no effect if text is currently being printed.

**Form Feed Button**
Pressing the form feed button advances the paper a preset number of lines. The form size is normally set to 11 inches but can be changed with a software command. If the automatic sheet feeder option (LQPX3-SF) is installed, a new sheet is inserted to the top of form position.

The form feed button is also used to start the self-tests in the self-test procedure. The form feed button has no effect if text is currently being printed or if the pause button has been pressed.

### Pause/Resume Button

When printing, pressing the pause/resume button immediately stops the printer without losing any text sent by the computer.

**NOTE**

**Opening the front access cover will also cause the printer to pause.**

When pausing, the green ready light continuously flashes and the form feed button is disabled. However, the paper advance and paper reverse buttons still function.

Pressing the pause/resume button resumes normal print operation.

### Ready Light (green)

| | |
|---|---|
| ON | Indicates the printer is on, operating normally, and ready to print. |
| FLASHING | Indicates the printer has paused.<br>The Ready light flashes if the pause/resume button has been pressed or, if the attend light is also on, operator attention is required. |
| OFF | Indicates power is off or, if the attend light is on, there is a malfunction (see "Troubleshooting the Printer"). |

### Attend Light (yellow)

| | |
|---|---|
| ON | Indicates the printer requires operator attention; see "Troubleshooting Printer" section of this manual. |
| OFF | Indicates the printer is operating correctly, no malfunction detected.<br>Note that the attend light is off if the printer paused at the operator's request (pause/resume button pressed) but is on if the printer has automatically paused due to a paper out or ribbon out condition. |

### Audible Alarm

The alarm sounds whenever operator attention is required to service the printer. The alarm also sounds when a data communication error (parity failure or buffer overflow) has been detected. See the "Troubleshooting the Printer" section in this manual.

**Front Access Cover Safety Switch**
The front access cover safety switch is actuated when the front access cover is opened. This stops the printer, disables the carriage, and informs the status protocol handler. When the cover is closed, the carriage and printwheel return to the active position. The pause condition is cleared when the operator presses the pause/resume button.

> **NOTE**
> **The paper advance and paper reverse buttons continue to function when the front access cover is open.**

### MECHANICAL CONTROLS AND INDICATORS

**Paper Bail Lever**
The paper bail lever allows movement of the paper bail when the front access cover is closed. Pushing the lever toward the rear of the printer holds the paper against the platen. Pulling the lever forward releases the paper from the paper bail.

**Paper Release Lever**
The paper release lever controls the pressure of rollers beneath the platen. Pushing the lever toward the rear of the printer holds the paper against the platen. Pulling the lever forward releases the paper.

The lever must be in the rear position for the printer to move the paper unless the LQPX3-FT Forms Tractor option is installed.

**Column Indicator**
The column indicator assists in positioning paper on the platen and locating the horizontal printing position. The column indicator is printed on the clear portion of the front access cover.

**Print Position Indicators**
The horizontal print position indicator is a raised line on the front of the ribbon cartridge. It indicates the center line of the column being printed.

The vertical print position indicator is a raised line on the sides of the ribbon cartridge. It indicates the center line of the line being printed.

## 2.3 PRINTER CONFIGURATION

The configuration switches are factory preset to the following positions:

## SWITCH PACK 1

### Baud Rate Select Switches (SP1-1,2,3)

Switches SP1-1,2,3 select the desired data communication baud rate.

| Rate | SP1-1 | SP1-2 | SP1-3 | |
|---|---|---|---|---|
| 110 | rear | rear | rear | |
| 200 | front | rear | rear | |
| 300 | rear | front | rear | |
| 600 | front | front | rear | |
| 1200 | rear | rear | front | |
| 2400 | front | rear | front | |
| 4800 | rear | front | front | (factory setting) |
| 9600 | front | front | front | |

### Self-test Switch (SP1-4)

Switch SP1-4 enables the printer self-tests when in the front position. This switch is factory set to the rear position.

### Stop Bit Switch (SP1-5)

Switch SP1-5 selects either one or two stop-bit transmission.

1 stop bit: front position (factory setting)
2 stop bits: rear position

### Data Length Switch (SP1-6)

Switch SP1-6 selects either 7 or 8 bit data length.

7 bit data: front position
8 bit data: rear position (factory setting)

### Parity Enable Switches (SP1-7,8)

Switches SP1-7 and 8 select the desired parity mode.

| Parity | SP1-7 | SP1-8 | |
|---|---|---|---|
| Odd | rear | rear | (7- or 8-bit) |
| Even | front | rear | (7- or 8-bit) |
| Mark | rear | front | (7-bit only) |
| Space | front | front | (7-bit only, factory setting) |

## SWITCH PACK 2

**Printwheel Language Code Switches (SP2-1,2,3,4)**
Switches SP2-1,2,3 and 4 select the desired printwheel code.

| **Language** | **SP2-1** | **SP2-2** | **SP2-3** | **SP2-4** | |
|---|---|---|---|---|---|
| US/ASCII | rear | rear | rear | rear | (factory setting) |
| Finnish | front | rear | rear | rear | |
| French | rear | front | rear | rear | |
| French Canadian | front | front | rear | rear | |
| German | rear | rear | front | rear | |
| Italian | front | rear | front | rear | |
| Japanese | rear | front | front | rear | |
| Norwegian/Danish | front | front | front | rear | |
| Spanish | rear | rear | rear | front | |
| Swedish | front | rear | rear | front | |
| United Kingdom | rear | front | rear | front | |

**Printer Identifier Selection Switch (SP2-8)**
Switch SP2-8 selects the identifier which the printer uses when communicating with the host computer. The LQP03 is factory set to identify itself as an LQP02 printer to allow compatibility with existing software.

LQP02 Identifier: front position (factory setting)
LQP03 Identifier: rear position

# CHAPTER 3
# DATA COMMUNICATION

## 3.1 CHARACTER PROCESSING

The terminal processes characters in accordance with the American National Standards Institute (ANSI) standard X3.4-1977. The ANSI system of character processing is based on the category (printable or control) of a character in the American National Standard Code for Information Interchange (ASCII) chart (Paragraph A.15). The category of a character is determined by the character's position in the ASCII chart. In the eight column chart, columns 0 and 1 contain the control characters while the rest of the chart contains printable characters (except for SP and DEL). The printer is capable of printing from 12 different character sets which are listed in Appendix A. SP and DEL are always the same control characters regardless of the character set selected. The communications format is described in the following paragraph.

**NOTE**

**Printing characters are refered to with the printed character followed by the octal code. For example, A (101) is the capital letter "A". Control characters are referred to with the mnemonic followed by the octal code. For example, SUB (032) is the substitute control character.**

## 3.2 DATA INTERFACE

The LQP03 data interface conforms electronically to RS-232C and functionally to a data-only subset of RS-449. A 25-pin plug on the underside of the printer connects to an interface cable. The interface cable carries the following signals.

| Pin | Function | To/From Printer | RS-449 Name | RS-232 Equivalent |
|---|---|---|---|---|
| 1 | Protective Ground | -- | Shield | -- |
| 2 | Send Data | From | SD | BA |
| 3 | Receive Data | To | RD | BB |
| 4 | Request To Send | From | RS | CA |
| 7 | Signal Ground | -- | SG | AB |
| 20 | Terminal Ready | From | TR | CD |

**NOTE**

**OFF condition = MARK state = binary 1 =**
**-5 to -6 volts (minimum)**
**ON condition = SPACE state = binary 0 =**
**+5 to +6 volts (minimum)**

The interface cable lines perform the following functions.

**Protective Ground**
This line is connected to the chassis ground of the printer. The chassis is further connected to external grounds through the third wire of the power line cord.

**Send Data**
The printer sends serial encoded characters to the host on this line. Configuration switches select the baud rate (110 to 9600), the data length (7 or 8 bits), the parity mode (Odd, Even, Mark, or Space), and the number of stop bits (1 or 2 bits).

**Receive Data**
The printer receives serial encoded characters from the host on this line. A configuration switch enables the printer's receiver to accept either 7- or 8-bit data.

**Request To Send**
The printer maintains this line in the ON condition at all times.

**Signal Ground**
This line establishes the common ground reference potential for all other interface circuits.

**Terminal Ready**
The status of this line indicates the readiness of the printer to send and receive data. When this line is ON the printer is ready for communication. After power on initialization, the printer maintains this line in the ON condition.

## 3.3 SERIAL DATA FORMAT

The LQP03 communicates using serial characters. The serial character format used must be the same as that used by the host computer. Serial characters are transmitted using a start bit (space), 7 or 8 data bits, an optional parity bit, and 1 or 2 stop bits (mark). Configuration switches select the number of data and stop bits and the type of parity. Figure 3-1 illustrates the serial data format.

## 3.4 DATA SYNCHRONIZATION

When the rate of data transfer to the printer is greater than the printer's throughput, a buffer synchronization protocol is employed. The printer signals the host to either stop or resume sending data according to the number of characters held in an input buffer.

### 3.4.1 Input Buffer

The input buffer has a 256 character capacity. All characters received, except **NUL** (000) Null, **DEL** (177) Delete, DC1 (021) Transmission Start, and DC3 (023) Transmission Stop, are temporarily stored in the input buffer before further processing. **NUL** (000) and **DEL** (177) are not stored in the buffer. The transmission stop and start control characters, DC1 (021) and **DC3** (023), are processed immediately.

Characters are stored in the input buffer until a line terminator is received, then the line is printed bidirectionally. A line terminator is a **CR** (015) Carriage Return, **LF** (012) Line Feed, **FF** (014) Form Feed, **VT** (013) Vertical Tab; or, when the wrap mode is enabled, it is any command which moves the active position past the right margin.

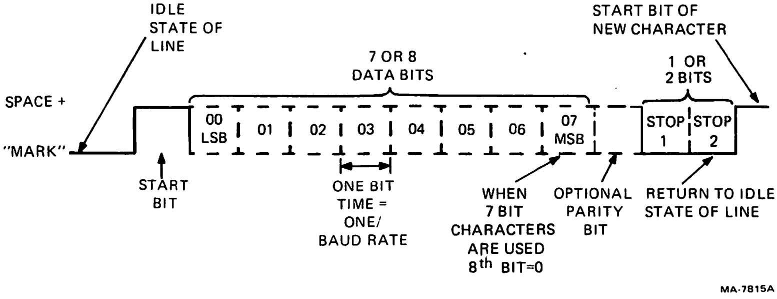

Figure 3-1 Serial Character Format

Buffer overflow is avoided by the action of the printer's buffer synchronization protocol (see section below for details). If a character is received with a parity error, the character is replaced in the input buffer by a **SUB** (032) Substitute control character. When processed, the **SUB** (032) control character causes the error mark, O (117) overstruck with **X** (130), to be printed at the location within the text where the error occurred as well as at the left margin.

When the printer is incapable of printing, the printer scans the input buffer for printer status request control sequences even if the buffer is full.

### 3.4.2 Buffer Synchronization Protocol

After successfully powering up and becoming enabled to send, the printer sends a DC1 (021) transmission start control character. It then constantly monitors the number of empty character positions in the input buffer. When the buffer is filled to the 128 character mark, the printer sends a DC3 (023) transmission stop control character. If the host continues to fill the buffer until there are 192 characters, a second DC3 (023) transmission stop control character is sent. Should the buffer fill up before the host stops sending, the excess data is lost and the status protocol handler is informed of the error. A single **SUB** (032) control character is placed in the buffer at the point of loss. This causes the error character, O (117) overstruck with **X** (130), to be printed at the point of loss in the text as well as at the left margin).

Meanwhile, the printer continues to take characters from the input buffer and print or otherwise process them. When there are more than 239 empty positions in the input buffer, the printer sends a DC1 (021) character, to signal that transmission may resume.

The printer also sends a DC3 (023) transmission stop control character when it is not ready to receive data due to an error condition or operator action. When an error that prevents printing occurs, the **DC3** (023) transmission stop control character is not sent until it normally would be, that is, when there are less than 128 empty positions in the input buffer. When the error condition is cleared, the operator resets the printer by pushing the Pause/Resume switch. When the Pause/Resume switch is used to stop printing, the printer continues to receive data according to the buffer synchronization protocol.

# CHAPTER 4
# CONTROL COMMANDS

## 4.1 GENERAL

Three types of software commands control the LQP03: control characters, escape sequences, and control sequences. Functional descriptions and software codes for all control commands are presented in this section.

## 4.2 CONTROL CHARACTERS

Control characters are single-character control commands. Control characters direct the printer's physical actions and communication functions. Only the ASCII (American National Standard Code for Information Interchange, ANSI standard X3.4-1977) control characters listed in Table 4-1 are recognized by the LQP03, all others are ignored.

Two character escape sequences from ESC @ 033 100 to ESC @ 033 137 can be replaced by an equivalent control character from 200 to 237 in 8-bit mode. These 8-bit control characters are mapped one-to-one with the two-character escape sequences.

For example, the sequence ESC K 033 113 for partial line down can be invoked in 8-bit mode by a control character 213. The control character compresses the data, since only one character, rather than two, is required.

## 4.3 ESCAPE SEQUENCE SYNTAX

Escape sequences are multiple-character control commands. All escape sequences begin with an ESC (033) character, followed by one or more additional characters. When the ESC (033) character is followed immediately by a [ (133) character, the command is one of a subset of escape sequences called control sequences. Control sequences are discussed in the next section, Control Sequence Syntax.

The LQP03 uses escape sequences standardized by the American National Standards Institute (ANSI standards X3.41-1974 and X3.64-1979) to control many of its features. For the LQP03 features that lack an ANSI standard escape sequence, additional escape sequences have been defined and are within the extensions permitted by the ANSI system.

**Table 4-1 Control Character Codes and Functions**

| Name | Mnemonic (Octal Code) | Function | (See Paragraph) |
|---|---|---|---|
| Backspace | BS (010) | Controls Active Column | (4.8) |
| Horizontal Tab | HT (011) | Controls Tabulation Stops | (4.12) |
| Line Feed | LF (012) | Controls Active Line | (4.9) |
| Vertical Tab | VT (013) | Controls Tab Stops | (4.12) |
| Form Feed | FF (014) | Controls Active Line | (4.9) |
| Carriage Return | CR (015) | Controls Active Column | (4.8) |
| Space | SP (040) | Controls Active Column | (4.8) |
| Inc AL by VAI | IND (204) | Controls Active Line | (4.9) |
| Inc AP to Next Line | NEL (205) | Controls Active Position | (4.10) |
| Set Horiz. Tab at AC | HTS (210) | Controls Tab Stops | (4.12) |
| Set Vert. Tab at AL | VTS (212) | Controls Tab Stops | (4.12) |
| Inc AL by Half VAI | PLD (213) | Controls Active Line | (4.9) |
| Dec AL by Half VAI | PLU (214) | Controls Active Line | (4.9) |
| Dec AL by VAI | RI (215) | Controls Active Line | (4.9) |
| Control Seq Intro | CSI (233) | Controls Sequence Syntax | (4.3) |
| Null | NUL (000) | For timing, not stored in buffer. Causes no operation. | |
| End of Transmission | EOT (004) | Disconnects modem line. | |
| Bell | BEL (007) | Sounds alarm. | |
| Transmission Start | DC1 (021) | Tells host to send data. | |

**Table 4-1 Control Character Codes and Functions**

| Name | Mnemonic (Octal Code) | Function | (See Paragraph) |
|---|---|---|---|
| Transmission Stop | DC3 (023) | Tells host to stop sending. | |
| Cancel | CAN (030) | Cancels previous character or current control function. | |
| Substitute | SUB (032) | Prints error character O (117) overprinted by X (130). | |
| Escape | ESC (033) | Introduces escape and control sequences. | |
| Delete | DEL (177) | For timing, not stored in buffer. Causes no operation. | |

## 4.4 CONTROL SEQUENCE SYNTAX

Control sequences are multiple-character control commands which contain one or more parameters. For example, a control sequence sets the horizontal pitch to 10, 12, or 15 characters per inch depending on the parameter value used. All control sequences begin with the sequence ESC [ (033 133). In an 8-bit environment the ESC [ (033 133) sequence can be replaced by the Control Sequence Introducer character, CSI (233). Those control sequences which begin with the sequence **ESC [ ?** (033 133 077) are privately defined by Digital and are not standardized by ANSI.

Parameter values contain from one to three numeric characters, **0** through **9** (060 through 071). Leading zeros are ignored; trailing zeros cause the command to be aborted. If a parameter value is not specified, a default value is selected. Some control sequences do not contain an explicit parameter specification because the default is always intended.

There are two kinds of parameters, numeric and selective.

Numeric parameters are used in control commands where an actual numeric value must be specified, such as the location of a tab stop or the number of lines per page. The mnemonic **Pn** is used to represent a numeric parameter in command sequences.

Selective parameters are used in those control commands which require selection from a list of related actions and in reports which communicate one of several possible messages. The mnemonic **Ps** is used to represent a selective parameter.

The printer stores received control sequence parameters in a 16-parameter parsing buffer. The buffer is parsed using the following guidelines.

- Parameters within a sequence are separated by a **;** (073) character.
- If a parameter is not specified where required, a null parameter is assumed. For example, three null parameters are assumed in the sequence:

```
ESC  [    ;    ;    a
033  133  073  073  141

Assumed:  Pn   Pn   Pn
          000  000  000
```

- If a null parameter occurs at the end of a string, the last **;** (073) character is not required. For example, if the control sequence command in the above example requires four parameters, a fourth null parameter would also be assumed.
- Null characters, NUL (000), are automatically removed from any sequence. They are not stored in the input buffer.

- Omission of a parameter value causes either a default value to be selected or no action to occur, depending on the command involved.

- The sixteenth buffer location is reserved for the last parameter sent in the event of an overflow. That is, if more than 16 parameters are sent, the buffer will contain the first 15 and the last one sent.

- If a control character occurs within an escape sequence, the control function is executed first. Then parsing of the sequence continues.

- An escape sequence is aborted and a new parsing sequence begun if any of the following conditions occurs.

  A **CAN** (030) Cancel control character is encountered.

  A **SUB** (032) Substitute control character is encountered.

  An **ESC** (033) Escape control character is encountered.

  A parameter's maximum value is exceeded or contains illegal or unknown values.

## 4.5 THE ACTIVE POSITION

The active column (vertical) and active line (horizontal) are collectively known as the active position. Active column is the column where the next character is to be printed. Active line is the line where the next character is to be printed. Printed characters usually increment the active column. Linefeeds, vertical tabs, and form feeds increment the active line. Active position is only loosely linked to the physical position of the printer carriage and paper mechanism. In general, the active column is only recorded when a character is actually printed.

The width of a column is adjustable and referred to as the horizontal advance increment (HAI). The unit of distance between lines is also adjustable and referred to as the vertical advance increment (VAI).

Column and line numbers begin with one, not zero. Column numbers do not have fractional components. Line numbers may have fractional components if the VAI is changed within a page.

## 4.6 PARAMETER DEFAULTS

When the LQP03 is turned on or re-initialized (RIS escape sequence command) the following parameters assume their default values.

| Parameter | Default |
|---|---|
| Horizontal Pitch | 10 characters/inch |
| Vertical Pitch | 6 lines/inch |
| Form Length | 66 lines |
| Left Margin | Column 1 |
| Right Margin | Column 110 |
| Top Margin | Line 1 |
| Bottom Margin | Line 66 |
| Active Position | Column 1, Line 1 |
| Horizontal Tabs | Every 8 columns (9, 17, 25...161) |
| Vertical Tabs | Every 8 lines (9, 17, 25...105) |
| Unsolicited Status Reports | Disabled |
| Right Margin Wrap Mode | Disabled |
| New Line Mode | Disabled |
| Underlining | Disabled |
| Bolding (Bold 1, Bold 2) | Disabled |
| Shadow Printing | Disabled |
| Positioning Unit Mode (PUM) | Disabled |
| Proportional Space | Disabled |
| Right Justification | Disabled |
| Active Printwheel Table | Monospaced |
| Underline Character | ASCII Code (137) |
| GL Set | Defined by G0 |
| GR Set | Defined by G2 |
| G0 Pointer | Switch Selectable (shipped with ASCII) |
| G1 Pointer | ASCII |
| G2 Pointer | Multinational |
| G3 Pointer | ASCII |

## 4.7 CONTROLLING THE ADVANCE INCREMENTS

### 4.7.1 Setting Vertical and Horizontal Advance Increments Using Numeric Parameters

| Mnemonic | Sequence | | | | | | |
|---|---|---|---|---|---|---|---|
| **SPI** | ESC | [ | Pnv | ; | Pnh | SP | G |
| | 033 | 133 | *** | 073 | *** | 040 | 107 |

$15 \leq \mathbf{Pnv} \leq 960$ (1/720 inch units)

$6 \leq \mathbf{Pnh} \leq 768$ (1/720 inch units)

The **Pnv** numeric parameter sets the vertical advance increment (VAI) and the **Pnh** numeric parameter sets the horizontal advance increment (HAI). **Pnv** and **Pnh** are in units of decipoint (1/720 inch). However, the resolution of control offered by the printer is much less. The printer divides **Pnv** by 15 to yield VAI in units of 1/48 inch. Similarly, **Pnh** is divided by 6 yielding HAI in units of 1/120 inch. The remainders after division are discarded. If a either **Pnv** or **Pnh** are omitted from the command, the existing parameter will not be altered.

When executed, this sequence also clears the horizontal and vertical margins.

### 4.7.2 Setting Horizontal Advance Increment Using a Selective Parameter

| **Mnemonic** | **Sequence** | | | |
|---|---|---|---|---|
| **DECSHORP** | **ESC** | **[** | **Ps** | **w** |
| | 033 | 133 | *** | 167 |

| **Ps Value** | **Horizontal Pitch (columns/inch)** | **HAI size (1/120 inch units)** |
|---|---|---|
| **Ps** omitted | 10 | 12 |
| 0 1 5 6 7 8<br>060, 061, 065, 066, 067, or 070 | 10 | 12 |
| 2 3 4<br>062, 063, or 064 | 12 | 10 |
| 9<br>071 | 15 | 8 |

Selects a horizontal pitch of 10, 12, or 15 columns/inch depending upon the value of selective parameter **Ps**. Clears the horizontal margins; left margin is column 1, right margin is the largest number column allowed at the new pitch. Column positions are recomputed.

### 4.7.3 Setting Vertical Advance Increment Using a Selective Parameter

| Mnemonic | Sequence | | | |
|---|---|---|---|---|
| DECVERP | ESC | [ | Ps | z |
| | 033 | 133 | *** | 172 |

| Ps Value | Vertical Pitch (lines/inch) | VAI size (1/48 inch units) |
|---|---|---|
| 0 1<br>060, 061, or no Ps | 6 | 8 |
| 2 3<br>062 or 063 | 8 | 6 |
| 4<br>064 | 2 | 24 |
| 5<br>065 | 3 | 16 |
| 6<br>066 | 4 | 12 |

Selects a vertical pitch of 2,3,4,6, or 8 lines/inch depending upon the value of selective parameter Ps. Vertical margins are cleared and the line positions recomputed.

### 4.7.4 Setting Proportional Spacing

| Mnemonic | Sequence | | | | | |
|---|---|---|---|---|---|---|
| DECPSP (Set) | ESC | [ | ? | 2 | 7 | h |
| | 033 | 133 | 077 | 062 | 067 | 150 |
| DECPSP (Clear) | ESC | [ | ? | 2 | 7 | l (lowercase L) |
| | 033 | 133 | 077 | 062 | 067 | 154 |

When set, the space provided between each printed character is determined by an algorithm which considers the visual effect of adjacent characters to produce a smoother and denser line of type.

The proportional spacing algorithm adds the two character escapement values in 1/120 inch units to determine the spacing increment between any two adjacent characters. The algorithm uses the escapements that are present in the proportional space table of the printer (see Appendix B).

When clear, the printer moves one horizontal advance increment (HAI) after printing any character. The size of the HAI can be set by either Setting VAI and HAI Using Numeric Parameters (SPI) or Setting HAI Using a Selective Parameter (DECSHORP).

### 4.7.5 Setting Proportional Mode Space Size

| **Mnemonic** | **Sequence** | | | | |
|---|---|---|---|---|---|
| **DECSS** | ESC | [ | Pn | ! | y |
| | 033 | 133 | *** | 041 | 171 |

6 ≤ **Pn** ≤ 768 (decipoint units, 1/720 inch)

Sets the horizontal increment of the Space **SP** (040) command when printer is in proportional mode (DECPSP set). In nonproportional mode, Space **SP** (040) uses HAI as the horizontal increment.

### 4.7.6 Setting the Positioning Unit Mode

| **Mnemonic** | **Sequence** | | | | |
|---|---|---|---|---|---|
| **PUM (Set)** | **ESC** | **[** | **1** | **1** | **h** |
| 033 | 033 | 133 | 061 | 061 | 150 |
| **PUM (Clear)** | **ESC** | **[** | **1** | **1** | **l** (lowercase L) |
| 033 | 033 | 133 | 061 | 061 | 154 |

Selects the positioning unit for the commands listed below (either the fine resolution of complete primitive control or the coarser resolution of VAI and HAI).

| **Mnemonic** | **Function** |
|---|---|
| HPA | Setting Active Column to Absolute Position |
| HPB | Decrementing Active Column to Relative Position |
| HPR | Incrementing Active Column to Relative Position |
| VPA | Setting Active Line to Absolute Position |
| VPB | Decrementing Active Line to Relative Position |
| VPR | Incrementing Active Line to Relative Position |

When PUM is set, the horizontal positioning unit is 1/120 inch and the vertical positioning unit is 1/48 inch. However, the numeric parameters, **Pn**'s, used in positioning commands are entered in units of 1/720 inch. The parameter values are divided by the appropriate factors to yield positioning units (the remainders from division, if any, are discarded). Also, no implied horizontal motion will be added to printed characters, as is done with shadow printing. This provides for complete primitive control of the printer.

When PUM is cleared, the Horizontal Advance Increment (HAI) and the Vertical Advance Increment (VAI) are used as the positioning units. The sizes of HAI and VAI can be set by Setting VAI and HAI Using Numeric Parameters (SPI) or Setting HAI and Setting VAI Using a Selective Parameter (DECSHORP and DECVERP respectively).

## 4.8 CONTROLLING THE ACTIVE COLUMN

### 4.8.1 Control of the Active Column by Control Characters

| Mnemonic (Octal) | Function |
|---|---|
| SP (040) | Space -- In nonproportional mode, SP (040) advances the active column by HAI. In proportional mode (DECPSP set), the active column is advanced by the amount specified by the DECSS command. Unlike other control characters, SP (040) takes up space in the printer's line buffer. SP (040) is also a valid control sequence character and therefore cannot be arbitrarily inserted as a fill character. |
| BS (010) | Backspace -- In nonproportional mode BS (010) decrements the active column by HAI. Contiguous BS (010) commands are allowed. In proportional mode (DECPSP set), BS (010) decrements the active column by the previous character's implied motion (as given in the proportional table), except if the previous character was SP (040) or any other motion command. In those cases, the active column is decremented by the amount specified in the proportional mode space size command (DECSS). If the active column is at the left margin, the backspace command is ignored. |
| CR (015) | Carriage Return -- Returns the active column to the left margin. |
| HT (011) | Horizontal Tab -- Advances the active column to the next horizontal tab. If there is no tab present, the active column will be located at the right margin or, if right margin wrap mode (DECAWM) is set, at the left margin of the next line. |

### 4.8.2 Setting Active Column to Absolute Position

| Mnemonic | Sequence | | | |
|---|---|---|---|---|
| HPA | ESC | [ | Pn | |
| | 033 | 133 | *** | 140 |

| | | |
|---|---|---|
| PUM Clear | $0 \leq Pn \leq 165$ | (HAI units) |
| PUM Set | $0 \leq Pn \leq 7920$ | (1/720 inch units,<br>1/120 inch increments) |

When PUM is cleared, the active column is moved to column Pn (if Pn is 0, the active column is set to column 1). The absolute position in inches relative to column 1 is given by the equation (Pn - 1) X (HAI/120).

When PUM is set, the active column is moved (Pn/6 - 1)/120 inches relative to the zero inch position on the column indicator. Any remainder in the division is discarded. If $0 \leq Pn \leq 6$, the active column is moved to column 1.

### 4.8.3 Decrementing Active Column to Relative Position

| Mnemonic | Sequence | | | |
|---|---|---|---|---|
| HPB | ESC | [ | Pn | j |
| | 033 | 133 | *** | 152 |

| | | |
|---|---|---|
| PUM Clear | $0 \leq Pn \leq 165$ | (HAI units) |
| PUM Set | $0 \leq Pn \leq 7920$ | (1/720 inch units,<br>1/120 inch increments) |

When PUM is cleared, the active column is decremented by Pn columns. The amount moved is Pn X (HAI/120) inches. If Pn is zero the active column is decremented one column.

When PUM is set, the active column is decremented by (Pn/720) inches. If $0 \leq Pn \leq 6$, the active column is decremented by one positioning unit (1/120 inch).

### 4.8.4 Incrementing Active Column to Relative Position

| Mnemonic | Sequence | | | |
|---|---|---|---|---|
| HPR | ESC | [ | Pn | a |
| 033 | 033 | 133 | *** | 141 |

| | | |
|---|---|---|
| PUM Clear | $0 \le Pn \le 165$ | (HAI units) |
| PUM Set | $0 \le Pn \le 7920$ | (1/720 inch units,<br>1/120 inch increments) |

When PUM is cleared, the active column is incremented by Pn columns. The amount moved is Pn x (HAI/120) inches. If Pn is zero the active column is incremented one column.

When PUM is set, the active column is incremented by (Pn/720) inches. If $0 \le Pn \le 6$, the active column is incremented by one positioning unit (1/120 inch).

## 4.9 CONTROLLING THE ACTIVE LINE

### 4.9.1 Control of the Active Line by Control Characters

| Character | Function |
|---|---|
| LF (012) | Line Feed -- Advances the active line by adding VAI to the present line position. |
| FF (014) | Form Feed -- Advances the active line to the first line on the next page. Skips over the bottom margin of the present page and the top margin of the new page. |
| VT (013) | Vertical Tab -- Advances the active line to the next vertical tab. If there is no tab present, the active line is moved to the first line of the next page (past the bottom margin of the present page and the top margin of the next page). |

When the New Line Mode (LNM) is set, the actions of the Line Feed LF (012), Form Feed FF (014), and Vertical Tab VT (010) commands are modified. In addition to the normal advancement of the active line caused by these commands, the active position is moved to the left margin of the next line. Note that, to ensure future conformance to ANSI and ISO standards, the New Line Mode (LNM) should not be used.

The escape sequences that control the active line relocation are described below. In addition, the following 8-Bit Control Characters for the equivalent 7-Bit Sequences are also described below.

| **Character** | **Name** |
|---|---|
| **IND** (204) | Incrementing the Active Line by VAI |
| **PLD** (213) | Incrementing the Active Line by One-Half VAI |
| **PLU** (214) | Decrementing the Active Line by One-Half VAI |
| **RI** (215) | Decrementing the Active Line by VAI |

### 4.9.2 Setting Active Line to Absolute Position

| **Mnemonic** | **Sequence** | | | |
|---|---|---|---|---|
| **VPA** | **ESC** | **[** | **Pn** | **d** |
| | 033 | 133 | *** | 144 |

PUM Clear $0 \le \mathbf{Pn} \le 168$ (VAI units)
PUM Set $0 \le \mathbf{Pn} \le 15360$ (1/720 inch units, 1/120 inch increments)

When PUM is cleared, the active line is moved to line **Pn** (if **Pn** is 0, the active line is set to line 1). The absolute position in inches relative to line 1 is expressed in the following equation.

$$[(\mathbf{Pn} - 1) \times (VAI/48)] + (VAI/96)$$

When PUM is set, the active line is moved (**Pn**/15 - 1)/48 inches relative to the zero inch position on the line indicator. Any remainder in the division is discarded. If $0 \le \mathbf{Pn} \le 15$, the active line is moved to line 1.

### 4.9.3 Decrementing Active Line to Relative Position

| **Mnemonic** | **Sequence** | | | |
|---|---|---|---|---|
| **VPB** | **ESC** | **[** | **Pn** | **k** |
| | 033 | 133 | *** | 153 |

PUM Clear $0 \le \mathbf{Pn} \le 168$ (VAI units)
PUM Set $0 \le \mathbf{Pn} \le 15360$ (1/720 inch units, 1/120 inch increments)

When PUM is cleared, the active line is decremented by **Pn** lines. The amount moved is **Pn** X (VAI/120) inches. If **Pn** is zero the active line is decremented one line.

When PUM is set, the active line is decremented by (**Pn**/120) inches. If $0 \le$ **Pn** $\le$ 15, the active line is decremented by one positioning unit (1/48 inch).

If using VPB to control the LQP03-FT Bidirectional Forms Tractor, see the "Reverse Tractor Movement" section.

### 4.9.4 Incrementing Active Line to Relative Position

| **Mnemonic** | **Sequence** | | | |
|---|---|---|---|---|
| **VPR** | **ESC** | **[** | **Pn** | **e** |
| | 033 | 133 | *** | 145 |

| | | |
|---|---|---|
| PUM Clear | $0 \le$ **Pn** $\le 168$ | (VAI units) |
| PUM Set | $0 \le$ **Pn** $\le 15360$ | (1/720 inch units,<br>1/48 inch increments) |

When PUM is cleared, the active line is incremented by **Pn** lines. The amount moved is **Pn** X (VAI/48) inches. If **Pn** is zero the active line is incremented one line.

When PUM is set, the active line is incremented by (**Pn**/15)/48 inches. If $0 \le$ **Pn** $\le$ 15, the active line is incremented by one positioning unit (1/48 inch).

### 4.9.5 Incrementing the Active Line by VAI

| **Mnemonic** | **Sequence** | | **8-Bit Character** |
|---|---|---|---|
| **IND** | **ESC** | **D** | **IND** |
| | 033 | 104 | 204 |

Moves the active line forward one VAI. The size of VAI is set by either the SPI or DECVERP command.

### 4.9.6 Decrementing the Active Line by VAI

| **Mnemonic** | **Sequence** | | **8-Bit Character** |
|---|---|---|---|
| **RI** | **ESC** | **M** | **RI** |
| | 033 | 115 | 215 |

Moves the active line backward one VAI.

If using RI to control the LQP03-FT Bidirectional Forms Tractor, see the "Reverse Tractor Movement" section.

### 4.9.7 Incrementing the Active Line by One-Half VAI

| Mnemonic | Sequence | | 8-Bit Character |
|---|---|---|---|
| PLD | ESC | K | PLD |
| | 033 | 113 | 213 |

Moves the active line forward one-half VAI. Performed before printing a subscript character and after printing a superscript character.

### 4.9.8 Decrementing the Active Line by One-Half VAI

| Mnemonic | Sequence | | 8-Bit Character |
|---|---|---|---|
| PLU | ESC | L | PLU |
| | 033 | 114 | 214 |

Moves the active line backward one-half VAI before printing a superscript character and after printing a subscript character.

If using PLU to control the LQP03-FT Bidirectional Forms Tractor, see "Reverse Tractor Movement" (Paragraph 4.14.2)

## 4.10 CONTROLLING THE ACTIVE POSITION

### 4.10.1 Incrementing Active Position to Beginning of Next Line

| Mnemonic | Sequence | | 8-Bit Character |
|---|---|---|---|
| NEL | ESC | E | NEL |
| | 033 | 105 | 205 |

Moves the active position to the left margin of the next line.

### 4.10.2 Setting the New Line Mode

| Mnemonic | Sequence | | | | |
|---|---|---|---|---|---|
| LNM (Set) | ESC | [ | 2 | 0 | h |
| | 033 | 133 | 062 | 060 | 150 |
| LNM (Clear) | ESC | [ | 2 | 0 | l (lowercase L) |
| | 033 | 133 | 062 | 060 | 154 |

NOTE

Use of this mode is discouraged by ISO standard 6429. ANSI standard X3.64 specifies that this mode applies only to the Line Feed, LF (012), command. To ensure future conformance do not use this mode for any purpose.

When the New Line Mode is set, the actions of the Line Feed **LF** (012), Form Feed **FF** (014), and Vertical Tab **VT** (010) commands are modified. In addition to the normal advance of the active line caused by these commands, the active position is moved to the left margin of the next line.

When the New Line Mode is cleared, only the active line is advanced by Line Feed, Form Feed, and Vertical Tab commands.

### 4.10.3 Sum and Perform Pending Motion

| Mnemonic | Sequence | | |
|---|---|---|---|
| DECFPP | ESC | # | 9 |
| | 033 | 043 | 071 |

Forces any buffered positioning commands to be summed and executed immediately.

## 4.11 CONTROLLING PAGE MARGINS

### 4.11.1 Setting Left and Right Margins

| Mnemonic | Sequence | | | | | |
|---|---|---|---|---|---|---|
| DECSLRM | ESC | [ | Pnl | ; | Pnr | s |
| | 033 | 133 | *** | 073 | *** | 163 |

$0 \leq Pnl, Pnr \leq 256$ (HAI units)

$Pnl < Pnr$

The location of the left margin is set by **Pnl**. The right margin is set by **Pnr**. If either parameter is omitted or set equal to zero, the existing margin will remain unchanged. Upon execution of this command, the active column is moved to the new left margin.

### 4.11.2 Setting Top and Bottom Margins

| Mnemonic | Sequence | | | | | |
|---|---|---|---|---|---|---|
| DECSTBM | ESC | [ | Pnt | ; | Pnb | r |
| | 033 | 133 | *** | 073 | *** | 162 |

$0 \leq Pnt, Pnb \leq 168$ (VAI units)

$Pnt < Pnb$

The location of the top margin is set by **Pnt**. The bottom margin is set by **Pnb**. If either parameter is omitted or set equal to zero, the existing margin will remain unchanged. Upon execution of this command, the active position is moved to the first printing position of the next page.

### 4.11.3 Setting Lines Per Page

| Mnemonic | Sequence | | | |
|---|---|---|---|---|
| DECSLPP | ESC | [ | Pn | t |
| | 033 | 133 | *** | 164 |

Pn ≤ 168 (VAI units)

The current active line becomes the top margin and is defined as line 1. The location of the bottom margin is set by Pn.

### 4.11.4 Setting the Right Margin Wrap Mode

| Mnemonic | Sequence | | | | |
|---|---|---|---|---|---|
| DECAWM (Set) | ESC | [ | ? | 7 | h |
| | 033 | 133 | 077 | 067 | 150 |
| DECAWM (Clear) | ESC | [ | ? | 7 | l (lowercase L) |
| | 033 | 133 | 077 | 067 | 154 |

When the right margin wrap mode is set, the active position is moved to the left margin of the next line when printing is attempted beyond the right margin.

## 4.12 CONTROLLING TABULATION STOPS

### 4.12.1 Setting Horizontal Tab at Active Column

| Mnemonic | Sequence | | 8-Bit Character |
|---|---|---|---|
| HTS | ESC | H | HTS |
| | 033 | 110 | 210 |

Sets a horizontal tab stop at the active column.

### 4.12.2 Setting Vertical Tab at Active Line

| Mnemonic | Sequence | | 8-Bit Character |
|---|---|---|---|
| VTS | ESC | J | VTS |
| | 033 | 112 | 212 |

Sets a vertical tab stop at the active line.

### 4.12.3 Setting Horizontal Tab Stops

| Mnemonic | Sequence | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| DECSHTS | ESC | [ | Pn1 | ; | ... | ; | Pn16 | u |
| | 033 | 133 | *** | 073 | ... | 073 | *** | 165 |

$Pn \leq 165$ (HAI units)

Sets up to sixteen horizontal tab stops at the positions given by the parameter values.

### 4.12.4 Setting Vertical Tab Stops

| Mnemonic | Sequence | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| DECSVTS | ESC | [ | Pn1 | ; | ... | ; | Pn16 | v |
| | 033 | 133 | *** | 073 | ... | 073 | *** | 166 |

$Pn \leq 168$ (VAI units)

Sets up to sixteen vertical tab stops at the positions given by the parameter values.

### 4.12.5 Clearing Tabs

| Mnemonic | Sequence | | | |
|---|---|---|---|---|
| TBC | ESC | [ | Ps | g |
| | 033 | 133 | *** | 147 |

| Ps Value | Function |
|---|---|
| 0<br>060, or no Ps | Clear horizontal tab at active column. |
| 1<br>061 | Clear vertical tab at active line. |
| 3<br>063 | Clear all horizontal tabs. |
| 4<br>064 | Clear all vertical tabs. |

Clears one or more vertical or horizontal tabulation stops, depending on the value of selective parameter Ps.

## 4.13 CONTROLLING HIGH LEVEL PRINTER FUNCTIONS

### 4.13.1 Right Justification

| Mnemonic | Sequence | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| DECFIL | ESC | [ | Pn1 | ; | Pn2 | ; | Pn3 | ; | Pn4 | ! | s |
| | 033 | 133 | *** | 073 | *** | 073 | *** | 073 | *** | 041 | 163 |

0 ≤ **Pn1** ≤ 1535 (1/720 inch units, 1/120 inch increments)
0 ≤ **Pn2** ≤ 255 (number of printing characters)
0 ≤ **Pn3** ≤ 1535 (1/720 inch units, 1/120 inch increments)
0 ≤ **Pn4** ≤ 255 (number of spaces)

| Parameter | Meaning |
|---|---|
| Pn1 | The amount added to each printing character. |
| Pn2 | The number of printing characters to which an additional 1/120 inch is added, if necessary. |
| Pn3 | The amount added to each space. |
| Pn4 | The number of spaces to which an additional 1/120 inch is added, if necessary. |

The Right Justification function produces an even right margin of text by dividing the unused portion of each line among the components of that line. The control sequence must precede each line to be justified. Contiguous Backspace BS (010) characters are not permitted.

### 4.13.2 Character Enhancement -- Underlining

| Mnemonic | Sequence | | | |
|---|---|---|---|---|
| SGR (Set) | ESC | [ | 4 | m |
| (Underline) | 033 | 133 | 064 | 155 |

Causes the underline attribute to be overprinted on characters between trigger and terminator characters. The underline attribute is determined by the DECUND command and can be any character between ! (041) and ~ (176). The default underline attribute is the underline character, _ (137). A segment is triggered by the first printing character, Space SP (040), or Horizontal Tab HT (011) command encountered. A segment is terminated by the first Carriage Return CR (015) or vertical motion command, other than PLU or PLD, encountered. A segment is also terminated if the VAI changes.

To clear the underlining mode, see to the Clear Character Enhancements command (Section 4.13.7).

### 4.13.3 Selecting the Underline Attribute

| Mnemonic | Sequence | | | | |
|---|---|---|---|---|---|
| DECUND | ESC | [ | Pn | ! | w |
| | 033 | 133 | *** | 041 | 167 |

$32 \leq Pn \leq 126$ (Decimal ASCII code)

Selects the printing character used as the underline attribute by the underline function (one of the SGR commands). The numeric parameter value, Pn, is the decimal ASCII code of the desired character. The current underline attribute remains in effect if Pn equals zero or is omitted. The power-up initialization value is 95, which is the decimal code for the underline character, (137).

### 4.13.4 Character Enhancement -- Bolding

| Mnemonic | Sequence | | | | |
|---|---|---|---|---|---|
| SGR (Set) | ESC | [ | 1 | m | |
| (Bold 1) | 033 | 133 | 061 | 155 | |
| SGR (Set) | ESC | [ | ? | 1 | m |
| (Bold 2) | 033 | 133 | 077 | 061 | 155 |

When using an inked cloth ribbon, a darker character can be obtained if the impression is repeated. From one to four hammer strikes per character can be selected by the combined status of these two commands.

| | Bold 2 Clear | Bold 2 Set |
|---|---|---|
| Bold 1 Clear | one strike | two strikes |
| Bold 1 Set | three strikes | four strikes |

To clear the bolding modes, see to the Clear Character Enhancements command (Section 4.13.7).

### 4.13.5 Character Enhancement -- Shadow Printing

| Mnemonic | Sequence | | | | |
|---|---|---|---|---|---|
| SGR (Set) | ESC | [ | ? | 2 | m |
| (Shadow) | 033 | 133 | 077 | 062 | 155 |

Shadow printing provides emphasis when printing with a carbon film ribbon or as an alternative to bolding when using an inked cloth ribbon. Normally, a character is printed once, the carriage is advanced 1/120 inch, and the same character is printed again. This produces a shadow effect which emphasizes the text. Diacriticals are automatically not shadow printed.

To clear shadow printing mode, see to the Clear Character Enhancements command (Section 4.13.7).

### 4.13.6 Disable Print Hammer

| Mnemonic | Sequence | | | |
|---|---|---|---|---|
| SGR (Set) | ESC | [ | 8 | m |
| (Hammer off) | 033 | 100 | 070 | 155 |

Disables the print hammer. To re-enable the print hammer refer to the Clear Character Enhancements command.

### 4.13.7 Clear Character Enhancements

| Mnemonic | Sequence | | | |
|---|---|---|---|---|
| SGR (Clear) | ESC | [ | 0 | m |
| | 033 | 133 | 060 | 155 |

Clears all SGR functions simultaneously. Stops further underlining, bolding, and shadow printing. Enables hammer if previously disabled.

### 4.13.8 Re-initialization

| Mnemonic | Sequence | |
|---|---|---|
| RIS | ESC | c |
| | 033 | 143 |

Invokes the printer's power up routine at any time. A logical self-test is performed and, if successful, the default values (see PARAMETER DEFAULTS section) are set for all parameters. A DC1 (021) Transmission Start command is sent to the host when the printer is ready for operation.

### 4.13.9 Device Identification Request/Report

| Mnemonic | Sequence | | |
|---|---|---|---|
| DA | ESC | [ | c |
| | 033 | 133 | 143 |

Causes the printer to respond with a device identification report which depends on the printer mode (LQP03 or LQP02).

| Device | Report | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| LQP03 | ESC | [ | ? | 2 | 4 | ; | Ps | c |
| | 033 | 133 | 077 | 062 | 064 | 073 | *** | 143 |
| LQP02 | ESC | [ | ? | 1 | 3 | ; | Ps | c |
| | 033 | 133 | 077 | 061 | 063 | 073 | *** | 143 |

| Ps Value | Meaning |
|---|---|
| 0<br>060 | No options present |
| 2<br>062 | Single-Tray Sheet Feeder (LQPX3-SF) present |
| 3<br>063 | Dual-Tray Sheet Feeder (LQPX3-DT) present |

If the printer responds with the LQP02 Identification Sequence, Configuration Switch SP2-8 has been set to provide LQP02 emulation. The printer sends a maximum of 100 characters per second at the baud rate to which it has been set.

### 4.13.10 Device Status Request/Report

The DSR command is used by the host to request a status report or to enable and disable unsolicited reporting. The DSR command is used by the printer to provide both brief and extended reports.

When an extended report is sent by the printer it is always preceded by a brief report. The communication I/O error and input buffer overflow error are cleared after the extended report is sent. The printer sends a maximum of 100 characters per second at the configured baud rate.

| Mnemonic | Sequence | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| DSR | ESC | [ | Ps | ; | ... | ; | Ps | n |
| | 033 | 133 | *** | 073 | ... | 073 | *** | 156 |

| Ps Value(s) | Request |
|---|---|
| 5<br>065 | Send extended report |
| ? 1<br>077 061 | Disable all unsolicited reports |
| ? 2<br>077 062 | Enable brief unsolicited reports and send one extended report |
| ? 3<br>077 063 | Enable extended unsolicited reports and send one extended report |
| | **Brief Reports** |
| 0<br>060 | Ready (no malfunction detected) |
| 3<br>063 | Not ready (malfunction detected) |

| | | | Extended Reports |
|---|---|---|---|
| ?<br>077 | 2<br>062 | 0<br>060 | Ready (no malfunctions detected) |
| ?<br>077 | 2<br>062 | 1<br>061 | Printer hardware error |
| ?<br>077 | 2<br>062 | 2<br>062 | Communication I/O error |
| ?<br>077 | 2<br>062 | 3<br>063 | Input buffer overflow |
| ?<br>077 | 2<br>062 | 4<br>064 | Printer pausing |
| ?<br>077 | 2<br>062 | 6<br>066 | Front access cover open |
| ?<br>077 | 2<br>062 | 7<br>067 | Paper out |
| ?<br>077 | 2<br>062 | 8<br>070 | Ribbon out |
| ?<br>077 | 2<br>062 | 9<br>071 | Attempted to downline load the LQP03 |
| ?<br>077 | 3<br>063 | 0<br>060 | Sheet feeder ready (no malfunction detected) |
| ?<br>077 | 3<br>063 | 2<br>062 | Sheet feeder insert error |

## 4.14 CONTROLLING PRINTER OPTIONS

### 4.14.1 Sheet Feeder Paper Insert/Eject

| Mnemonic | Sequence | | | |
|---|---|---|---|---|
| DECASFC | ESC<br>033 | Ps<br>*** | !<br>041 | v<br>166 |

| Ps Value | Meaning |
|---|---|
| 0<br>060, or no Ps | Eject paper |
| 1<br>061 | Insert paper from tray 1 |

| | |
|---|---|
| 2<br>062 | Insert paper from tray 2 (if applicable, otherwise tray 1) |
| 3<br>063 | Insert paper from tray 3 (if applicable, otherwise tray 1) |

Causes the sheet feeder to eject or insert one sheet of paper depending on the value of selective parameter Ps. If no sheet feeder option is present, the above sequence will perform a form feed function.

### 4.14.2 Reverse Tractor Movement

The following note applies only to reverse movement commands performed on the LQPX3-FT Bidirectional Forms Tractor. Reverse movement commands are those which decrement the active line; namely, Decrementing Active Line to a Relative Position (VPB), Decrementing the Active Line by VAI (RI), and Decrementing the Active Line by One-Half VAI (PLU).

For the most accurate line registration:

- The initial reverse paper movement should overshoot the desired line by two lines, then
- The paper should be advanced to the desired line.

# APPENDIX A
# CHARACTER SET CHARTS

The LQP03 can print any one of 12 character sets. The character set selection process and the various character sets are described in the following paragraphs.

## A.1 PRINTING CHARACTERS

The 94 characters from ! (041) to ~ (176) are printed from the currently selected printwheel parameter table. At system initialization, Table 1 is the active table (see Appendix B).

In LQP02 Mode only, two special escape sequences are used to print the "copyright" and "paragraph" graphic characters. This provides backward compatibility with software written for the original LQP02 which used these sequences to access printwheel positions (040) and (177). These sequences are:

| **Mnemonic** | **Sequence** | | |
|---|---|---|---|
| SS3(1): | ESC<br>033 | O<br>117 | !<br>041 |

Print the copyright symbol.

| | | | |
|---|---|---|---|
| SS3(2): | ESC<br>033 | O<br>117 | "<br>042 |

Print the paragraph symbol (Pilcrow).

## A.2 CHARACTER SET SELECTION

The printer is considered to be in 7-bit mode if the data length switch has been set to 7. In 7-bit mode, all characters are printed from the GL character set.

The printer is considered to be in 8-bit mode if the number of data bits has been set to 8. In 8-bit mode, all characters are printed from the GL character set if the eighth bit is 0 or from the GR character set if the eighth bit is 1. The advantage of 8-bit mode is that two character sets (one in GL and one in GR) can be resident simultaneously.

A series of commands load GL and GR with character sets identified by one of four intermediate pointers, G0 through G3. (See Table A-1.) These pointers can be set to point to one of 12 available character sets (see Table A-2). At initialization, G0 points to one of 11 character sets (the multinational set is not allowed in G0 on initialization) defined by the dip switches, G1 and G3 both point to the ASCII set, and G2 points to the multinational set.

The following Character Set Escape Sequences (Table A-2) are used to assign a character set to the four pointers (G0 to G3).

**Table A-1 Active Character Set Selection**

| **Command** | **Mnemonic** | **Escape Sequence** | **GL Set** | **GR Set** |
|---|---|---|---|---|
| Locking Shift 0 | LS0 | (017) | G0 | -- |
| Locking Shift 1 | LS1 | (016) | G1 | -- |
| Single Shift 2 | SS2 | ESC N<br>033 116 | G2* | -- |
| Single Shift 3 | SS3 | ESC O<br>033 117 | G3* | -- |
| Locking Shift 2 | LS2 | ESC n<br>033 156 | G2 | -- |
| Locking Shift 3 | LS3 | ESC o<br>033 157 | G3 | -- |
| Locking Shift 1 Right | LS1R | ESC ~<br>033 176 | -- | G1 |
| Locking Shift 2 Right | LS2R | ESC }<br>033 175 | -- | G2 |
| Locking Shift 3 Right | LS3R | ESC \|<br>033 174 | -- | G3 |

* A special case in the SS2 and SS3 commands. When these commands are given, the next character printed is selected from the G2 or G3 pointers respectively, regardless of the setting of the eighth bit. After GL or GR set. The locking shift commands (LS2, LS3, LS1R, LS2R, or LS3R) remain in effect until another locking shift is received.

The following Character Set Escape Sequences (Table A-2) are used to assign a character set to the four pointers (G0 to G3).

**Table A-2 Character Set Selection Escape Sequences**

| G0 | G1 | G2 | G3 | Character Set |
|---|---|---|---|---|
| ESC(B | ESC)B | ESC*B | ESC+B | ASCII |
| ESC(A | ESC)A | ESC*A | ESC+A | U.K. |
| ESC(5 | ESC)5 | ESC*5 | ESC+5 | Finland |
| ESC(C | ESC)C | ESC*C | ESC+C | Finland |
| ESC(R | ESC)R | ESC*R | ESC+R | France |
| ESC(9 | ESC)9 | ESC*9 | ESC+9 | French Canada |
| ESC(Q | ESC)Q | ESC*Q | ESC+Q | French Canada |
| ESC(K | ESC)K | ESC*K | ESC+K | Germany |
| ESC(Y | ESC)Y | ESC*Y | ESC+Y | Italy |
| ESC(J | ESC)J | ESC*J | ESC+J | JIS Roman |
| ESC(6 | ESC)6 | ESC*6 | ESC+6 | Norway/Denmark |
| ESC(E | ESC)E | ESC*E | ESC+E | Norway/Denmark |
| ESC(Z | ESC)Z | ESC*Z | ESC+Z | Spain |
| ESC(7 | ESC)7 | ESC*7 | ESC+7 | Sweden |
| ESC(H | ESC)H | ESC*H | ESC+H | Sweden |
| ESC(< | ESC)< | ESC*< | ESC+< | Multinational |

## A.3 MULTINATIONAL CHARACTER SET

This graphic character set (Table A-3) consists of graphic alphabetic symbols not included in ASCII. Because this document is produced using only the ASCII character set, it is not possible to reproduce here the graphic symbols of the multinational character set. Graphic symbols of this character set shall be as specified by ISO 6937. The ID given for each character is a reference to ISO 6937 for the character in that standard having the same graphic symbol.

**NOTE**

Octal codes reserved for future use will cause the error character (an underline) to be printed.

**Table A-3 Multinational Character Set**

| Octal Code | ID | Character Description |
|---|---|---|
| 041 | SP03 | inverted exclamation mark |
| 042 | SC04 | cent sign |
| 043 | SC02 | pound sign |
| 044 | | error |
| 045 | SC05 | yen sign |
| 046 | | error |
| 047 | SM24 | section sign |
| 050 | SC01 | general currency sign |
| 051 | SM52 | copyright sign |
| 052 | SM21 | feminine ordinal indicator |
| 053 | SP17 | angle quotation mark left |
| 054 | | error |
| 055 | | error |
| 056 | | error |
| 057 | | error |
| 060 | SM19 | degree sign |
| 061 | SA02 | plus/minus sign |
| 062 | NS02 | superscript 2 |
| 063 | NS03 | superscript 3 |
| 064 | | error |
| 065 | SM17 | micro sign |
| 066 | SM25 | paragraph sign, pilcrow |
| 067 | SM26 | middle dot |
| 070 | | error |
| 071 | NS01 | superscript 1 |
| 072 | SM20 | masculine ordinal indicator |
| 073 | SP18 | angle quotation mark right |
| 074 | NF04 | fraction one quarter |
| 075 | NF01 | fraction one half |
| 076 | | error |
| 077 | SP16 | inverted question mark |
| 100 | LA14 | uppercase A w/grave accent |
| 101 | LA12 | uppercase A w/acute accent |
| 102 | LA16 | uppercase A w/circumflex accent |
| 103 | LA20 | uppercase A w/tilde |
| 104 | LA18 | uppercase A w/diaeresis or umlaut mark |
| 105 | LA28 | uppercase A w/ring |
| 106 | LA52 | uppercase AE diphthong |
| 107 | LC42 | uppercase C w/cedilla |
| 110 | LE14 | uppercase E w/grave accent |
| 111 | LE12 | uppercase E w/acute accent |
| 112 | LE16 | uppercase E w/circumflex accent |
| 113 | LE18 | uppercase E w/diaeresis or umlaut mark |
| 114 | LI14 | uppercase I w/grave accent |
| 115 | LI12 | uppercase I w/acute accent |
| 116 | LI16 | uppercase I w/circumflex accent |
| 117 | LI18 | uppercase I w/diaeresis |
| 120 | | error |
| 121 | LN20 | uppercase N w/tilde |

**Table A-3 Multinational Character Set (Cont)**

| Octal Code | ID | Character Description |
|---|---|---|
| 122 | LO14 | uppercase O w/grave accent |
| 123 | LO12 | uppercase O w/acute accent |
| 124 | LO16 | uppercase O w/circumflex accent |
| 125 | LO20 | uppercase O w/tilde |
| 126 | LO18 | uppercase O w/diaeresis or umlaut mark |
| 127 | LO52 | uppercase OE ligature |
| 130 | LO62 | uppercase O w/slash |
| 131 | LU14 | uppercase U w/grave accent |
| 132 | LU12 | uppercase U w/acute accent |
| 133 | LU16 | uppercase U w/circumflex accent |
| 134 | LU18 | uppercase U w/diaeresis or umlaut mark |
| 135 | LY18 | uppercase Y w/diaeresis or umlaut mark |
| 136 |  | error |
| 137 | LS61 | German lowercase sharp s |
| 140 | LA13 | lowercase a w/grave accent |
| 141 | LA11 | lowercase a w/acute accent |
| 142 | LA15 | lowercase a w/circumflex accent |
| 143 | LA19 | lowercase a w/tilde |
| 144 | LA17 | lowercase a w/diaeresis or umlaut mark |
| 145 | LA27 | lowercase a w/ring |
| 146 | LA51 | lowercase ae diphthong |
| 147 | LC41 | lowercase c w/cedilla |
| 150 | LE13 | lowercase e w/grave accent |
| 151 | LE13 | lowercase e w/acute accent |
| 152 | LE15 | lowercase e w/circumflex accent |
| 153 | LE17 | lowercase e w/diaeresis or umlaut mark |
| 154 | LI13 | lowercase i w/grave accent |
| 155 | LI11 | lowercase i w/acute accent |
| 156 | LI15 | lowercase i w/circumflex accent |
| 157 | LI17 | lowercase i w/diaeresis |
| 160 |  | error |
| 161 | LN19 | lowercase n w/tilde |
| 162 | LO13 | lowercase o w/grave accent |
| 163 | LO11 | lowercase o w/acute accent |
| 164 | LO15 | lowercase o w/circumflex accent |
| 165 | LO19 | lowercase o w/tilde |
| 166 | LO17 | lowercase o w/diaeresis or umlaut mark |
| 167 | LO51 | lowercase oe ligature |
| 170 | LO61 | lowercase o w/slash |
| 171 | LU13 | lowercase u w/grave accent |
| 172 | LU11 | lowercase u w/acute accent |
| 173 | LU15 | lowercase u w/circumflex accent |
| 174 | LU17 | lowercase u w/diaeresis or umlaut mark |
| 175 | LY17 | lowercase y w/diaeresis or umlaut mark |
| 176 |  | error |

## A.4 ASCII CHARACTER SETS

The ASCII character set is shown in Table A-4 with the graphic symbol shown over octal code.

**Table A-4** ASCII Character Set

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ! | " | # | $ | % | & | ' | ( | ) | * | + | ' | - | . | / | |
| 041 | 042 | 043 | 044 | 045 | 046 | 047 | 050 | 051 | 052 | 053 | 054 | 055 | 056 | 057 | |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | : | ; | < | = | > | ? |
| 060 | 061 | 062 | 063 | 064 | 065 | 066 | 067 | 070 | 071 | 072 | 073 | 074 | 075 | 076 | 077 |
| @ | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O |
| 100 | 101 | 102 | 103 | 104 | 105 | 106 | 107 | 110 | 111 | 112 | 113 | 114 | 115 | 116 | 177 |
| P | Q | R | S | T | U | V | W | X | Y | Z | [ | \ | ] | ^ | _ |
| 120 | 121 | 122 | 123 | 124 | 125 | 126 | 127 | 130 | 131 | 132 | 133 | 134 | 135 | 136 | 137 |
| ` | a | b | c | d | e | f | g | h | i | j | k | l | m | n | o |
| 140 | 141 | 142 | 143 | 144 | 145 | 146 | 147 | 150 | 151 | 152 | 153 | 154 | 155 | 156 | 157 |
| p | q | r | s | t | u | v | w | x | y | z | { | \| | } | ~ | |
| 160 | 161 | 162 | 163 | 164 | 165 | 166 | 167 | 170 | 171 | 172 | 173 | 174 | 175 | 176 | |

## A.5 BRITISH CHARACTER SET

The British character set differs from the ASCII character set in the following position.

| Octal Code | ASCII Symbol | ID | British Symbol Description |
|---|---|---|---|
| 043 | # | SC02 | pound sign |

## A.6 FINNISH CHARACTER SET

The Finnish character set differs from the ASCII character set in the following positions.

| Octal Code | ASCII Symbol | ID | Finnish Symbol Description |
|---|---|---|---|
| 133 | [ | LA18 | uppercase A w/umlaut |
| 134 | \ | LO18 | uppercase O w/umlaut |
| 135 | ] | LA28 | uppercase A w/ring |
| 136 | ^ | LE18 | uppercase U w/umlaut |
| 140 | ` | LE11 | lowercase e w/acute accent |
| 173 | { | LA17 | lowercase a w/umlaut |
| 174 | \| | LO17 | lowercase o w/umlaut |
| 175 | } | LA27 | lowercase a w/ring |
| 176 | ~ | LU17 | lowercase u w/umlaut |

## A.7 FRENCH CHARACTER SET

The French character set differs from the ASCII character set in the following positions:

| Octal Code | ASCII Symbol | ID | French Symbol Description |
|---|---|---|---|
| 043 | # | SC02 | pound sign |
| 100 | @ | LA13 | lowercase a w/grave accent |
| 133 | [ | SM19 | degree sign |
| 134 | \ | LC41 | lowercase c w/cedilla |
| 135 | ] | SM24 | section sign |
| 173 | { | LE11 | lowercase e w/acute accent |
| 174 | \| | LU13 | lowercase u w/grave accent |
| 175 | } | LE13 | lowercase e w/grave accent |
| 176 | ~ |  | diaresis, trema |

## A.8 FRENCH CANADIAN CHARACTER SET

| Octal Code | ASCII Symbol | ID | French Canadian Symbol Description |
|---|---|---|---|
| 100 | @ | LA13 | lowercase a w/grave accent |
| 133 | [ | LA15 | lowercase a w/circumflex accent |
| 134 | \ | LC41 | lowercase c w/cedilla |
| 135 | ] | LE15 | lowercase e w/circumflex accent |
| 136 | ^ | LI15 | lowercase i w/circumflex accent |
| 140 | ` | LO15 | lowercase o w/circumflex accent |
| 173 | { | LE11 | lowercase e w/acute accent |
| 174 | \| | LU13 | lowercase u w/grave accent |
| 175 | } | LE13 | lowercase e w/grave accent |
| 176 | ~ | LU15 | lowercase u w/circumflex accent |

## A.9 GERMAN CHARACTER SET

The German character set differs from the ASCII character set in the following positions.

| Octal Code | ASCII Symbol | ID | German Symbol Description |
|---|---|---|---|
| 100 | @ | SM24 | section sign |
| 133 | [ | LA18 | uppercase A w/umlaut |
| 134 | \ | LO18 | uppercase O w/umlaut |
| 135 | ] | LU18 | uppercase U w/umlaut |
| 173 | { | LA17 | lowercase a w/umlaut |
| 174 | \| | LO17 | lowercase o w/umlaut |
| 175 | } | LU17 | lowercase u w/umlaut |
| 176 | ~ | LS61 | sharp s |

## A.10 ITALIAN CHARACTER SET

The Italian character set differs from the ASCII character set in the following positions.

| Octal Code | ASCII Symbol | ID | Italian Symbol Description |
|---|---|---|---|
| 043 | # | SC02 | pound sign |
| 100 | @ | SM24 | section sign |
| 133 | [ | SM19 | degree sign |
| 134 | \ | LC41 | lowercase c w/cedilla |
| 135 | ] | LE11 | lowercase e w/acute accent |
| 140 | ` | LU13 | lowercase u w/grave accent |
| 173 | { | LA13 | lowercase a w/grave accent |
| 174 | \| | LO13 | lowercase o w/grave accent |
| 175 | } | LE13 | lowercase e w/grave accent |
| 176 | ~ | LI13 | lowercase i w/grave accent |

## A.11 JIS ROMAN CHARACTER SET

The JIS Roman character set differs from the ASCII character set in the following position.

| Octal Code | ASCII Symbol | ID | JIS Roman Symbol Description |
|---|---|---|---|
| 134 | \ | SC05 | yen sign |

## A.12 NORWEGIAN/DANISH CHARACTER SET

The Norwegian/Danish character set differs from the ASCII character set in the following positions.

| Octal Code | ASCII Symbol | ID | Norwegian/Danish Symbol Description |
|---|---|---|---|
| 100 | @ | LA18 | uppercase A w/umlaut |
| 133 | [ | LA52 | uppercase AE dipthong |
| 134 | \ | LO62 | uppercase O w/slash |
| 135 | ] | LA28 | uppercase A w/ring |
| 136 | ^ | LE18 | uppercase U w/umlaut |
| 140 | ` | LA17 | lowercase a w/umlaut |
| 173 | { | LA51 | lowercase ae diphthong |
| 174 | \| | LO61 | lowercase o w/slash |
| 175 | } | LA27 | lowercase a w/ring |
| 176 | ~ | LU17 | lowercase u w/umlaut |

## A.13 SPANISH CHARACTER SET

The Spanish character set differs from the ASCII character set in the following positions.

| Octal Code | ASCII Symbol | ID | Spanish Symbol Description |
|---|---|---|---|
| 043 | # | SC02 | pound sign |
| 100 | @ | SM24 | section sign |
| 133 | [ | SP03 | inverted exclamation mark |
| 134 | \ | LN20 | uppercase N w/tilde |
| 135 | ] | SP16 | inverted question mark |
| 173 | { | SM19 | degree sign |
| 174 | \| | LN19 | lowercase n w/tilde |
| 175 | } | LC41 | lowercase c w/cedilla |

## A.14 SWEDISH CHARACTER SET

The Swedish character set differs from the ASCII character set in the following positions.

| Octal Code | ASCII Symbol | ID | Swedish Symbol Description |
|---|---|---|---|
| 100 | @ | LE12 | uppercase E w/acute accent |
| 133 | [ | LA18 | uppercase A w/umlaut |
| 134 | \ | LO18 | uppercase O w/umlaut |
| 135 | ] | LA28 | uppercase A w/ring |
| 136 | ^ | LE18 | uppercase U w/umlaut |
| 140 | ` | LE11 | lowercase e w/acute accent |
| 173 | { | LA17 | lowercase a w/umlaut |
| 174 | \| | LO17 | lowercase o w/umlaut |
| 174 | } | LA27 | lowercase a w/ring |
| 176 | ~ | LU17 | lowercase u w/umlaut |

# A.15 ASCII CHART

| B8 B7 B6 B5 BITS | | 0 0 0 0 | 0 0 0 1 | 0 0 1 0 | 0 0 1 1 | 0 1 0 0 | 0 1 0 1 | 0 1 1 0 | 0 1 1 1 | 1 0 0 0 | 1 0 0 1 | 1 0 1 0 | 1 0 1 1 | 1 1 0 0 | 1 1 0 1 | 1 1 1 0 | 1 1 1 1 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B4 B3 B2 B1 | ROW | COLUMN 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| 0 0 0 0 | 0 | NUL<br>0<br>0<br>0 | 20<br>16<br>10 | SP<br>40<br>32<br>20 | 0<br>60<br>48<br>30 | @<br>100<br>64<br>40 | P<br>120<br>80<br>50 | `<br>140<br>96<br>60 | p<br>160<br>112<br>70 | 200<br>128<br>80 | 220<br>144<br>90 | ▨<br>240<br>160<br>A0 | °<br>260<br>176<br>B0 | À<br>300<br>192<br>C0 | 320<br>208<br>D0 | à<br>340<br>224<br>E0 | 360<br>240<br>F0 |
| 0 0 0 1 | 1 | 1<br>1<br>1 | DC1 (XON)<br>21<br>17<br>11 | !<br>41<br>33<br>21 | 1<br>61<br>49<br>31 | A<br>101<br>65<br>41 | Q<br>121<br>81<br>51 | a<br>141<br>97<br>61 | q<br>161<br>113<br>71 | 201<br>129<br>81 | 221<br>145<br>91 | ¡<br>241<br>161<br>A1 | ±<br>261<br>177<br>B1 | Á<br>301<br>193<br>C1 | Ñ<br>321<br>209<br>D1 | á<br>341<br>225<br>E1 | ñ<br>361<br>241<br>F1 |
| 0 0 1 0 | 2 | 2<br>2<br>2 | 22<br>18<br>12 | "<br>42<br>34<br>22 | 2<br>62<br>50<br>32 | B<br>102<br>66<br>42 | R<br>122<br>82<br>52 | b<br>142<br>98<br>62 | r<br>162<br>114<br>72 | 202<br>130<br>82 | 222<br>146<br>92 | ¢<br>242<br>162<br>A2 | 2<br>262<br>178<br>B2 | Â<br>302<br>194<br>C2 | Ò<br>322<br>210<br>D2 | â<br>342<br>226<br>E2 | ò<br>362<br>242<br>F2 |
| 0 0 1 1 | 3 | 3<br>3<br>3 | DC3 (XOFF)<br>23<br>19<br>13 | #<br>43<br>35<br>23 | 3<br>63<br>51<br>33 | C<br>103<br>67<br>43 | S<br>123<br>83<br>53 | c<br>143<br>99<br>63 | s<br>163<br>115<br>73 | 203<br>131<br>83 | 223<br>147<br>93 | £<br>243<br>163<br>A3 | 3<br>263<br>179<br>B3 | Ã<br>303<br>195<br>C3 | Ó<br>323<br>211<br>D3 | ã<br>343<br>227<br>E3 | ó<br>363<br>243<br>F3 |
| 0 1 0 0 | 4 | 4<br>4<br>4 | 24<br>20<br>14 | $<br>44<br>36<br>24 | 4<br>64<br>52<br>34 | D<br>104<br>68<br>44 | T<br>124<br>84<br>54 | d<br>144<br>100<br>64 | t<br>164<br>116<br>74 | IND<br>204<br>132<br>84 | 224<br>148<br>94 | 244<br>164<br>A4 | 264<br>180<br>B4 | Ä<br>304<br>196<br>C4 | Ô<br>324<br>212<br>D4 | ä<br>344<br>228<br>E4 | ô<br>364<br>244<br>F4 |
| 0 1 0 1 | 5 | ENQ<br>5<br>5<br>5 | 25<br>21<br>15 | %<br>45<br>37<br>25 | 5<br>65<br>53<br>35 | E<br>105<br>69<br>45 | U<br>125<br>85<br>55 | e<br>145<br>101<br>65 | u<br>165<br>117<br>75 | NEL<br>205<br>133<br>85 | 225<br>149<br>95 | ¥<br>245<br>165<br>A5 | µ<br>265<br>181<br>B5 | Å<br>305<br>197<br>C5 | Õ<br>325<br>213<br>D5 | å<br>345<br>229<br>E5 | õ<br>365<br>245<br>F5 |
| 0 1 1 0 | 6 | 6<br>6<br>6 | 26<br>22<br>16 | &<br>46<br>38<br>26 | 6<br>66<br>54<br>36 | F<br>106<br>70<br>46 | V<br>126<br>86<br>56 | f<br>146<br>102<br>66 | v<br>166<br>118<br>76 | 206<br>134<br>86 | 226<br>150<br>96 | 246<br>166<br>A6 | ¶<br>266<br>182<br>B6 | Æ<br>306<br>198<br>C6 | Ö<br>326<br>214<br>D6 | æ<br>346<br>230<br>E6 | ö<br>366<br>246<br>F6 |
| 0 1 1 1 | 7 | BEL<br>7<br>7<br>7 | 27<br>23<br>17 | '<br>47<br>39<br>27 | 7<br>67<br>55<br>37 | G<br>107<br>71<br>47 | W<br>127<br>87<br>57 | g<br>147<br>103<br>67 | w<br>167<br>119<br>77 | 207<br>135<br>87 | 227<br>151<br>97 | §<br>247<br>167<br>A7 | •<br>267<br>183<br>B7 | Ç<br>307<br>199<br>C7 | Œ<br>327<br>215<br>D7 | ç<br>347<br>231<br>E7 | œ<br>367<br>247<br>F7 |
| 1 0 0 0 | 8 | BS<br>10<br>8<br>8 | CAN<br>30<br>24<br>18 | (<br>50<br>40<br>28 | 8<br>70<br>56<br>38 | H<br>110<br>72<br>48 | X<br>130<br>88<br>58 | h<br>150<br>104<br>68 | x<br>170<br>120<br>78 | HTS<br>210<br>136<br>88 | 230<br>152<br>98 | ¤<br>250<br>168<br>A8 | 270<br>184<br>B8 | È<br>310<br>200<br>C8 | Ø<br>330<br>216<br>D8 | è<br>350<br>232<br>E8 | ø<br>370<br>248<br>F8 |
| 1 0 0 1 | 9 | HT<br>11<br>9<br>9 | 31<br>25<br>19 | )<br>51<br>41<br>29 | 9<br>71<br>57<br>39 | I<br>111<br>73<br>49 | Y<br>131<br>89<br>59 | i<br>151<br>105<br>69 | y<br>171<br>121<br>79 | 211<br>137<br>89 | 231<br>153<br>99 | ©<br>251<br>169<br>A9 | 1<br>271<br>185<br>B9 | É<br>311<br>201<br>C9 | Ù<br>331<br>217<br>D9 | é<br>351<br>233<br>E9 | ù<br>371<br>249<br>F9 |
| 1 0 1 0 | 10 | LF<br>12<br>10<br>A | SUB<br>32<br>26<br>1A | *<br>52<br>42<br>2A | :<br>72<br>58<br>3A | J<br>112<br>74<br>4A | Z<br>132<br>90<br>5A | j<br>152<br>106<br>6A | z<br>172<br>122<br>7A | VTS<br>212<br>138<br>8A | 232<br>154<br>9A | ª<br>252<br>170<br>AA | º<br>272<br>186<br>BA | Ê<br>312<br>202<br>CA | Ú<br>332<br>218<br>DA | ê<br>352<br>234<br>EA | ú<br>372<br>250<br>FA |
| 1 0 1 1 | 11 | VT<br>13<br>11<br>B | ESC<br>33<br>27<br>1B | +<br>53<br>43<br>2B | ;<br>73<br>59<br>3B | K<br>113<br>75<br>4B | [<br>133<br>91<br>5B | k<br>153<br>107<br>6B | {<br>173<br>123<br>7B | PLD<br>213<br>139<br>8B | CSI<br>233<br>155<br>9B | «<br>253<br>171<br>AB | »<br>273<br>187<br>BB | Ë<br>313<br>203<br>CB | Û<br>333<br>219<br>DB | ë<br>353<br>235<br>EB | û<br>373<br>251<br>FB |
| 1 1 0 0 | 12 | FF<br>14<br>12<br>C | 34<br>28<br>1C | ,<br>54<br>44<br>2C | <<br>74<br>60<br>3C | L<br>114<br>76<br>4C | \<br>134<br>92<br>5C | l<br>154<br>108<br>6C | \|<br>174<br>124<br>7C | PLU<br>214<br>140<br>8C | 234<br>156<br>9C | 254<br>172<br>AC | ¼<br>274<br>188<br>BC | Ì<br>314<br>204<br>CC | Ü<br>334<br>220<br>DC | ì<br>354<br>236<br>EC | ü<br>374<br>252<br>FC |
| 1 1 0 1 | 13 | CR<br>15<br>13<br>D | 35<br>29<br>1D | -<br>55<br>45<br>2D | =<br>75<br>61<br>3D | M<br>115<br>77<br>4D | ]<br>135<br>93<br>5D | m<br>155<br>109<br>6D | }<br>175<br>125<br>7D | RI<br>215<br>141<br>8D | 235<br>157<br>9D | 255<br>173<br>AD | ½<br>275<br>189<br>BD | Í<br>315<br>205<br>CD | Ÿ<br>335<br>221<br>DD | í<br>355<br>237<br>ED | ÿ<br>375<br>253<br>FD |
| 1 1 1 0 | 14 | LS1 (SO)<br>16<br>14<br>E | 36<br>30<br>1E | .<br>56<br>46<br>2E | ><br>76<br>62<br>3E | N<br>116<br>78<br>4E | ^<br>136<br>94<br>5E | n<br>156<br>110<br>6E | ~<br>176<br>126<br>7E | SS2<br>216<br>142<br>8E | 236<br>158<br>9E | 256<br>174<br>AE | 276<br>190<br>BE | Î<br>316<br>206<br>CE | 336<br>222<br>DE | î<br>356<br>238<br>EE | 376<br>254<br>FE |
| 1 1 1 1 | 15 | LS0 (SI)<br>17<br>15<br>F | 37<br>31<br>1F | /<br>57<br>47<br>2F | ?<br>77<br>63<br>3F | O<br>117<br>79<br>4F | _<br>137<br>95<br>5F | o<br>157<br>111<br>6F | DEL<br>177<br>127<br>7F | SS3<br>217<br>143<br>8F | 237<br>159<br>9F | 257<br>175<br>AF | ¿<br>277<br>191<br>BF | Ï<br>317<br>207<br>CF | ß<br>337<br>223<br>DF | ï<br>357<br>239<br>EF | ▨<br>377<br>255<br>FF |
| | | C0 CONTROL SET | | GL GRAPHIC SET (SHOWN HERE FILLED WITH ASCII CHARACTER SET) | | | | | | C1 CONTROL SET | | GR GRAPHIC SET (SHOWN HERE FILLED WITH DIGITAL MULTINATIONAL SET) | | | | | |

**LEGEND**

| CHARACTER | | |
|---|---|---|
| A | 101 | OCTAL |
| | 65 | DECIMAL |
| | 41 | HEX |

BLANK CHARACTERS ARE RESERVED FOR FUTURE USE AND WILL BE PRINTED AS ERRORS

MA-10,087D

# APPENDIX B
# ASCII PRINTWHEEL PARAMETER TABLES

Refer to the two printwheel parameter tables in this document for the information you need on character printing. Table B-1 is for monospacing, Table B-2 is for proportional spacing. Both are hard tables and are not down-line loadable.

These tables are contained in the servo level slave processor and reside in ROM. Consequently, these tables are not accessible to the serial line master processor nor to the host.

**Table B-1**

| Hex Code | Char | Spoke Addr | Ribbon | Hammer |
|---|---|---|---|---|
| 20 | -- | -- | -- | -- |
| 21 | ! | 94 | 2 | 3 |
| 22 | " | 108 | 3 | 2 |
| 23 | # | 16 | 3 | 4 |
| 24 | $ | 37 | 3 | 5 |
| 25 | % | 14 | 4 | 5 |
| 26 | & | 18 | 4 | 5 |
| 27 |  | 78 | 2 | 2 |
| 28 | ( | 17 | 2 | 4 |
| 29 | ) | 100 | 2 | 4 |
| 2A | * | 86 | 3 | 3 |
| 2B | + | 15 | 3 | 3 |
| 2C | ' | 114 | 2 | 1 |
| 2D | - | 104 | 3 | 2 |
| 2E | . | 102 | 2 | 1 |
| 2F | / | 112 | 3 | 4 |
| 30 | 0 | 23 | 3 | 4 |
| 31 | 1 | 19 | 3 | 3 |
| 32 | 2 | 20 | 3 | 4 |
| 33 | 3 | 21 | 3 | 4 |
| 34 | 4 | 24 | 3 | 4 |
| 35 | 5 | 22 | 3 | 4 |
| 36 | 6 | 25 | 3 | 4 |
| 37 | 7 | 26 | 3 | 4 |
| 38 | 8 | 27 | 3 | 4 |
| 39 | 9 | 28 | 3 | 4 |

**Table B-1 (Cont)**

| Hex Code | Char | Spoke Addr | Ribbon | Hammer |
|---|---|---|---|---|
| 3A | : | 82 | 2 | 1 |
| 3B | ; | 98 | 2 | 1 |
| 3C | < | 31 | 3 | 3 |
| 3D | = | 30 | 3 | 3 |
| 3E | > | 29 | 3 | 3 |
| 3F | ? | 88 | 3 | 3 |
| 40 | @ | 34 | 4 | 6 |
| 41 | A | 89 | 4 | 5 |
| 42 | B | 79 | 4 | 5 |
| 43 | C | 117 | 3 | 4 |
| 44 | D | 103 | 4 | 5 |
| 45 | E | 87 | 3 | 4 |
| 46 | F | 93 | 3 | 4 |
| 47 | G | 115 | 4 | 5 |
| 48 | H | 107 | 4 | 5 |
| 49 | I | 96 | 3 | 4 |
| 4A | J | 92 | 3 | 5 |
| 4B | K | 111 | 4 | 5 |
| 4C | L | 91 | 3 | 4 |
| 4D | M | 105 | 4 | 6 |
| 4E | N | 95 | 4 | 5 |
| 4F | O | 101 | 4 | 5 |
| 50 | P | 81 | 3 | 5 |
| 51 | Q | 127 | 4 | 6 |
| 52 | R | 99 | 4 | 5 |
| 53 | S | 85 | 3 | 5 |
| 54 | T | 83 | 4 | 4 |
| 55 | U | 97 | 4 | 5 |
| 56 | V | 90 | 4 | 4 |
| 57 | W | 113 | 4 | 6 |
| 58 | X | 109 | 3 | 5 |
| 59 | Y | 123 | 4 | 4 |
| 5A | Z | 77 | 4 | 4 |
| 5B | [ | 35 | 2 | 4 |
| 5C |  | 62 | 3 | 4 |
| 5D | ] | 33 | 2 | 4 |
| 5E | ^ | 59 | 3 | 2 |
| 5F |  | 84 | 9 | 1 |
| 60 | ⊤ | 76 | 3 | 2 |
| 61 | a | 124 | 4 | 4 |
| 62 | b | 9 | 3 | 4 |
| 63 | c | 5 | 3 | 4 |
| 64 | d | 1 | 3 | 4 |
| 65 | e | 130 | 3 | 3 |
| 66 | f | 116 | 3 | 3 |
| 67 | g | 6 | 3 | 5 |
| 68 | h | 2 | 3 | 4 |
| 69 | i | 3 | 3 | 3 |
| 6A | j | 120 | 3 | 3 |

Table B-1 (Cont)

| Hex Code | Char | Spoke Addr | Ribbon | Hammer |
|---|---|---|---|---|
| 6B | k | 10 | 3 | 4 |
| 6C | l | 122 | 3 | 3 |
| 6D | m | 119 | 4 | 6 |
| 6E | n | 129 | 3 | 4 |
| 6F | o | 125 | 3 | 4 |
| 70 | p | 8 | 4 | 4 |
| 71 | q | 11 | 4 | 5 |
| 72 | r | 126 | 3 | 4 |
| 73 | s | 128 | 3 | 4 |
| 74 | t | 118 | 3 | 4 |
| 75 | u | 4 | 3 | 4 |
| 76 | v | 110 | 4 | 3 |
| 77 | w | 121 | 4 | 5 |
| 78 | x | 12 | 3 | 4 |
| 79 | y | 7 | 4 | 4 |
| 7A | z | 13 | 3 | 4 |
| 7B | { | 54 | 2 | 4 |
| 7C | \| | 106 | 2 | 5 |
| 7D | } | 75 | 2 | 4 |
| 7E | ~ | 48 | 3 | 2 |
| 7F | -- | -- | -- | -- |
| 80 | -- | -- | -- | -- |
| 81 | ¡ | 69 | 2 | 3 |
| 82 | £ | 46 | 3 | 4 |
| 83 | § | 80 | 3 | 4 |
| 84 | © | 46 | 3 | 4 |
| 85 | ° | 36 | 2 | 2 |
| 86 | ² | 67 | 3 | 3 |
| 87 | ³ | 73 | 3 | 3 |
| 88 | ' | 50 | 3 | 2 |
| 89 | µ | 41 | 3 | 4 |
| 8A | ¶ | 61 | 3 | 4 |
| 8B | ¨ | 65 | 3 | 2 |
| 8C | ¹ | 40 | 3 | 3 |
| 8D | ¼ | 63 | 3 | 3 |
| 8E | ½ | 57 | 3 | 3 |
| 8F | ¿ | 71 | 3 | 3 |
| 90 | Ä | 74 | 4 | 5 |
| 91 | Æ | 66 | 4 | 6 |
| 92 | Ç | 60 | 3 | 4 |
| 93 | 1 | 43 | 3 | 3 |
| 94 | Ö | 72 | 4 | 5 |
| 95 | Œ | 64 | 4 | 6 |
| 96 | ü | 70 | 4 | 5 |
| 97 | ß | 47 | 4 | 5 |
| 98 | à | 58 | 4 | 4 |
| 99 | ä | 53 | 4 | 4 |

Table B-1 (Cont)

| Hex Code | Char | Spoke Addr | Ribbon | Hammer |
|---|---|---|---|---|
| 9A | å | 56 | 4 | 4 |
| 9B | æ | 49 | 4 | 5 |
| 9C | Ç | 45 | 3 | 4 |
| 9D | è | 55 | 3 | 3 |
| 9E | é | 52 | 3 | 3 |
| 9F | ñ | 51 | 3 | 4 |
| A0 | ò | 42 | 3 | 4 |
| A1 | ö | 38 | 3 | 4 |
| A2 | œ | 68 | 4 | 5 |
| A3 | ù | 44 | 3 | 4 |
| A4 | ü | 39 | 3 | 4 |

## B-1 MONOSPACED PRINTWHEEL PARAMETER TABLE

Table B-1 contains the standard nonWPS sequence of characters and attributes. This table is for monospacing and contains no character width information. At initialization, Table B-1 is selected as the active table.

The Hex Code column in Table B-1, represented in hexadecimal, identifies the ASCII character code which is translated into one or two Spoke Addresses required to correctly represent its graphic.

The Spoke Addr column contains the decimal printwheel position to be printed for the ASCII character code received.

The Ribbon column contains the ribbon advance information required for the selected Spoke Address.

The Hammer column in the table contains the hammer energy information required by the selected Spoke Address.

## B-2 PROPORTIONAL SPACED PRINTWHEEL PARAMETER TABLE

Table B-2 contains the standard non-WPS sequence of characters and attributes. However, this table also contains corresponding proportional escapement values (width) used in proportional printing. The description of each data field in Table B-2 corresponds with Table B-1, except for the width field.

The width column contains horizontal spacing information for proportional printing. Width of a character = Width/120 in inches.

## B-3 PRINTING CHARACTERS FROM A SPECIAL PRINTWHEEL

The following control sequence allows a user to print a character by specified printwheel position, ribbon advancement, hammer intensity and character width. This allows the user to print characters from a nonstandard printwheel. It is required that Proportional Spacing Mode (DECPSP) be set when using this sequece.

| **Mnemonic** | **Sequence** | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| DECPWC | ESC | [ | P1 | ; | P2 | ; | P3 | ; | P4 | " | x |
| | 033 | 133 | XXX | 073 | XXX | 073 | XXX | 073 | XXX | 042 | 170 |

| | | |
|---|---|---|
| P1 | SPOKE POSITION | The spoke positions are from 1 to 130, therefore the valid range for P1 is from 1 (061) to 1 (061) 3 (063) 0 (060). |
| P2 | RIBBON VALUE | The ribbon advancements are from 0 to 7, therefore the P2 value should range from 0 (060) to 7 (067). |

| | | |
|---|---|---|
| P3 | HAMMER VALUE | The hammer intensities are from 0 to 7, therefore the P3 value should range from 0 (060) to 7 (067). When the 0 hammer value is specified, the hammer will be disabled. The value 7 has the same hammer intensity as using value 6. |
| P4 | CHARACTER WIDTH | The P4 value should range from 0 (060) to 9 (071). The character width is given by the formula [P4 x 2]/120 in inches. If the width is specified as 0 (060) then the carriage will not move after the character is printed. This can be used to compose characters. |

**NOTE**

**This control sequence is ignored, if any parameter is out of range.**

### B-4 PRINTWHEEL TABLE SELECT

The following sequence selects either Table B-1 or Table B-2 as the active table. In proportional mode, Table B-2 is always selected as the active table.

| Mnemonic | Sequence |
|---|---|
| DECPTS | ESC [ Ps ! x<br>033 133 xxx 041 170 |

| Ps | Meaning |
|---|---|
| no Ps or NUL<br>000 | Select Table B-1 |
| 0 or 1<br>060 061 | Select Table B-1 |
| 2<br>062 | Select Table B-2 |

### B-5 PROGRAMMED COMPOSITE CHARACTERS

Since the LQP03 printwheel has only 130 printwheel positions, some characters, such as many of the diacritical characters, have been composed from two printwheel characters internal to the printer. This capability allows the use of composite characters without host control, thereby minimizing activity on the serial bus.

Table B-2

| Hex Code | Char | Spoke Addr | Ribbon | Hammer | Width |
|---|---|---|---|---|---|
| 20 | -- | -- | -- | -- | -- |
| 21 | ! | 94 | 3 | 3 | 5 |
| 22 | " | 108 | 3 | 2 | 5 |
| 23 | # | 16 | 4 | 4 | 5 |
| 24 | $ | 37 | 4 | 5 | 5 |
| 25 | % | 14 | 4 | 5 | 5 |
| 26 | & | 18 | 4 | 5 | 6 |
| 27 |  | 78 | 2 | 2 | 2 |
| 28 | ( | 17 | 3 | 3 | 5 |
| 29 | ) | 100 | 3 | 3 | 5 |
| 2A | * | 86 | 4 | 3 | 5 |
| 2B | + | 15 | 4 | 2 | 5 |
| 2C | , | 114 | 2 | 1 | 5 |
| 2D | - | 104 | 4 | 1 | 5 |
| 2E | . | 102 | 2 | 1 | 5 |
| 2F | / | 112 | 5 | 4 | 5 |
| 30 | 0 | 23 | 4 | 4 | 5 |
| 31 | 1 | 19 | 2 | 3 | 5 |
| 32 | 2 | 20 | 4 | 4 | 5 |
| 33 | 3 | 21 | 4 | 4 | 5 |
| 34 | 4 | 24 | 4 | 4 | 5 |
| 35 | 5 | 22 | 4 | 4 | 5 |
| 36 | 6 | 25 | 4 | 4 | 5 |
| 37 | 7 | 26 | 4 | 4 | 5 |
| 38 | 8 | 27 | 4 | 4 | 5 |
| 39 | 9 | 28 | 4 | 4 | 5 |
| 3A | : | 82 | 2 | 1 | 5 |
| 3B | ; | 98 | 3 | 1 | 5 |
| 3C | < | 31 | 4 | 2 | 6 |
| 3D | = | 30 | 4 | 2 | 5 |
| 3E | > | 29 | 4 | 2 | 6 |
| 3F | ? | 88 | 3 | 2 | 5 |
| 40 | @ | 34 | 4 | 6 | 5 |
| 41 | A | 89 | 5 | 5 | 7 |
| 42 | B | 79 | 5 | 6 | 7 |
| 43 | C | 117 | 5 | 5 | 7 |
| 44 | D | 103 | 5 | 6 | 7 |
| 45 | E | 87 | 5 | 6 | 6 |
| 46 | F | 93 | 6 | 4 | 6 |
| 47 | G | 115 | 7 | 6 | 7 |
| 48 | H | 107 | 7 | 6 | 7 |
| 49 | I | 96 | 4 | 4 | 4 |
| 4A | J | 92 | 5 | 4 | 5 |
| 4B | K | 111 | 7 | 6 | 7 |
| 4C | L | 91 | 6 | 4 | 6 |
| 4D | M | 105 | 7 | 6 | 7 |
| 4E | N | 95 | 7 | 6 | 7 |
| 4F | O | 101 | 7 | 6 | 7 |

Table B-2 (Cont)

| Hex Code | Char | Spoke Addr | Ribbon | Hammer | Width |
|---|---|---|---|---|---|
| 50 | P | 81 | 6 | 6 | 6 |
| 51 | Q | 127 | 7 | 6 | 7 |
| 52 | R | 99 | 7 | 6 | 7 |
| 53 | S | 85 | 6 | 6 | 6 |
| 54 | T | 83 | 7 | 4 | 7 |
| 55 | U | 97 | 7 | 5 | 7 |
| 56 | V | 90 | 7 | 5 | 7 |
| 57 | W | 113 | 7 | 6 | 7 |
| 58 | X | 109 | 7 | 5 | 7 |
| 59 | Y | 123 | 7 | 4 | 7 |
| 5A | Z | 77 | 6 | 4 | 6 |
| 5B | [ | 35 | 3 | 4 | 5 |
| 5C | | 62 | 5 | 4 | 5 |
| 5D | ] | 33 | 3 | 4 | 5 |
| 5E | ^ | 59 | 3 | 2 | 5 |
| 5F | _ | 84 | 5 | 2 | 6 |
| 60 | | 76 | 3 | 2 | 5 |
| 61 | a | 124 | 5 | 4 | 5 |
| 62 | b | 9 | 5 | 5 | 6 |
| 63 | c | 5 | 4 | 4 | 5 |
| 64 | d | 1 | 5 | 5 | 6 |
| 65 | e | 130 | 4 | 3 | 5 |
| 66 | f | 116 | 4 | 3 | 4 |
| 67 | g | 6 | 5 | 6 | 6 |
| 68 | h | 2 | 5 | 5 | 6 |
| 69 | i | 3 | 3 | 3 | 3 |
| 6A | j | 120 | 3 | 3 | 3 |
| 6B | k | 10 | 5 | 4 | 6 |
| 6C | l | 122 | 3 | 3 | 3 |
| 6D | m | 119 | 5 | 6 | 7 |
| 6E | n | 129 | 5 | 4 | 6 |
| 6F | o | 125 | 4 | 4 | 5 |
| 70 | p | 8 | 5 | 5 | 6 |
| 71 | q | 11 | 5 | 5 | 6 |
| 72 | r | 126 | 4 | 3 | 5 |
| 73 | s | 128 | 4 | 4 | 5 |
| 74 | t | 118 | 3 | 3 | 4 |
| 75 | u | 4 | 5 | 4 | 6 |
| 76 | v | 110 | 4 | 3 | 6 |
| 77 | w | 121 | 5 | 5 | 7 |
| 78 | x | 12 | 5 | 4 | 6 |
| 79 | y | 7 | 5 | 4 | 6 |
| 7A | z | 13 | 4 | 4 | 5 |
| 7B | { | 54 | 3 | 4 | 5 |
| 7C | \| | 106 | 3 | 4 | 3 |
| 7D | } | 75 | 3 | 4 | 5 |
| 7E | ~ | 48 | 3 | 2 | 5 |
| 7F | -- | -- | -- | -- | -- |

Table B-2 (Cont)

| Hex Code | Char | Spoke Addr | Ribbon | Hammer | Width |
|---|---|---|---|---|---|
| 80 | -- | -- | -- | -- | -- |
| 81 | ¡ | 69 | 3 | 3 | 5 |
| 82 | £ | 46 | 4 | 5 | 6 |
| 83 | § | 80 | 4 | 4 | 5 |
| 84 | © | 46 | 5 | 6 | 8 |
| 85 | ° | 36 | 2 | 2 | 5 |
| 86 | ² | 67 | 3 | 2 | 5 |
| 87 | ³ | 73 | 3 | 2 | 5 |
| 88 | ´ | 50 | 3 | 2 | 5 |
| 89 | µ | 41 | 5 | 4 | 6 |
| 8A | ¶ | 61 | 4 | 6 | 4 |
| 8B | ¨ | 65 | 3 | 2 | 5 |
| 8C | ¹ | 40 | 3 | 2 | 5 |
| 8D | ¼ | 63 | 3 | 3 | 5 |
| 8E | ½ | 57 | 3 | 3 | 5 |
| 8F | ¿ | 71 | 3 | 2 | 3 |
| 90 | Ä | 74 | 5 | 5 | 7 |
| 91 | Æ | 66 | 5 | 6 | 7 |
| 92 | Ç | 60 | 5 | 5 | 7 |
| 93 | ı | 43 | 3 | 3 | 3 |
| 94 | Ö | 72 | 5 | 6 | 7 |
| 95 | Œ | 64 | 5 | 6 | 7 |
| 96 | Ü | 70 | 5 | 5 | 7 |
| 97 | ß | 47 | 5 | 6 | 6 |
| 98 | à | 58 | 5 | 4 | 5 |
| 99 | ä | 53 | 5 | 4 | 5 |
| 9A | å | 56 | 5 | 4 | 5 |
| 9B | æ | 49 | 5 | 5 | 7 |
| 9C | ç | 45 | 4 | 4 | 5 |
| 9D | è | 55 | 4 | 3 | 5 |
| 9E | é | 52 | 4 | 3 | 5 |
| 9F | ñ | 51 | 5 | 4 | 6 |
| A0 | ò | 42 | 4 | 4 | 5 |
| A1 | ö | 38 | 4 | 4 | 5 |
| A2 | œ | 68 | 5 | 5 | 7 |
| A3 | ù | 44 | 5 | 4 | 6 |
| A4 | ü | 39 | 5 | 4 | 6 |

# MNEMONIC INDEX

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| VPR | | Incrementing Active Line to Relative Position | 32 |
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